# AIM

## Version 4

## A Computer Program for Making HIV/AIDS Projections and Examining the Social and Economic Impacts of AIDS

Spectrum System of Policy Models

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# I. Introduction

## A. Description of the Spectrum System

### 1. Components

The POLICY Project and its predecessor projects have developed computer models that analyze existing information to determine the future consequences of today's population programs and policies. The new Spectrum Policy Modeling System consolidates previous models into an integrated package containing the following components:

*Spectrum consolidates DemProj, FamPlan, Benefit-Cost, AIM, and RAPID models into an integrated package.*

- **Demography (DemProj)** – A program to make population projections based on (1) the current population, and (2) fertility, mortality, and migration rates for a country or region.
- **Family Planning (FamPlan)** – A program to project family planning requirements in order for consumers and/or nations to reach their goals of contraceptive practice or desired fertility.
- **Benefit-Cost** – A program for comparing the costs of implementing family planning programs, along to the benefits generated by those programs.
- **AIDS (AIDS Impact Model – AIM)** – A program to project the consequences of the AIDS epidemic.
- **Socioeconomic Impacts of High Fertility and Population Growth (RAPID)** – A program to project the social and economic consequences of high fertility and rapid population growth for sectors such as labor force, education, health, urbanization and agriculture.

### 2. Software Description

Spectrum is a Windows-based system of integrated policy models. The integration is based on DemProj, which is used to create the population projections that support many of the calculations in the other components—FamPlan, Benefit-Cost, AIM, and RAPID.

Each component has a similarly functioning interface which is easy to learn and to use. With little guidance, anyone who has a basic familiarity with Windows software will readily be able to navigate the models to create population projections and to estimate resource and infrastructure requirements. The accompanying manuals contain both instructions for users, and equations for persons who want to know exactly how the underlying calculations are computed.

## B. Uses of Spectrum Policy Models

*Policy models are designed to answer a number of "what if" questions. The "what if" refers to factors that can be changed or influenced by public policy.*

Policy models are designed to answer a number of "what if" questions relevant to entities as small as local providers of primary health care services and as large as international development assistance agencies. The "what if" refers to factors that can be changed or influenced by public policy.

Models are commonly computerized when analysts need to see the likely result of two or more forces that might be brought

to bear on an outcome, such as a population's illness level or its degree of urbanization. Whenever at least three variables are involved (such as two forces and one outcome), a computerized model can both reduce the burden of manipulating those variables and present the results in an accessible way.

Some of the policy issues commonly addressed by the Spectrum set of models include:

- the utility of taking actions earlier rather than later. Modeling shows that little in a country stands still while policy decisions are stalled and that many negative outcomes can accumulate during a period of policy stasis.
- the evaluation of the costs vs. the benefits of a course of actions. Modeling can show the economic efficiency of a set of actions (i.e. whether certain outcomes are achieved more effectively than under a different set of actions), or simply whether the cost of a single set of actions is acceptable for the benefits gained.
- the recognition of inter-relatedness. Modeling can show how making a change in one area of population dynamics (such as migration rates) may necessitate changes in a number of other areas (such as marriage rates, timing of childbearing, etc.).
- the need to discard monolithic explanations and policy initiatives. Modeling can demonstrate that simplistic

explanations may bear little relationship to how the "real world" operates.

*A set of policies under consideration may not be acceptable to all stakeholders.*

- the utility of "door openers." A set of policies under consideration may not be acceptable to all stakeholders. Modeling can concentrate on favored goals and objectives and demonstrate how they are assisted by the proposed policies.
- that few things in life operate in a linear fashion. A straight line rarely describes social or physical behavior. Most particularly, population growth, being exponential, is so far from linear that its results are startling. Modeling shows that all social sectors based on the size of population groups are heavily influenced by the exponential nature of growth over time.
- that a population's composition greatly influences its needs and its well being. How a population is composed—in terms of its age and sex distribution—has broad-ranging consequences for social welfare, crime rates, disease transmission, political stability, etc. Modeling demonstrates the degree to which a change in age and sex distribution can affect a range of social indicators.
- the effort required to "swim against the current." A number of factors can make the success of a particular program harder to achieve; for example, the waning of breastfeeding in a population increases the need for contraceptive coverage. Modeling can illustrate the need for extra effort—even if simply to keep running in place.

## C. Organization of the Model Manuals

Each manual begins with a discussion of what the model does and why someone would want to use it. The manual also explains the data decisions and assumptions needed before the model can be run, and possible sources for the data. It defines the data inputs and outputs. The manual contains two tutorials, information on the methodology behind the model, a glossary, and a bibliography.

## D. Information about the POLICY Project

The POLICY Project is a USAID-funded activity designed to create a supportive environment for family planning and reproductive health programs through the promotion of a participatory process and population policies that respond to client needs. To achieve its purpose, the project addresses the full range of policies that support the expansion of family planning and other reproductive health services, including:

- national policies as expressed in laws and in official statements and documents;
- operational policies that govern the provision of services;
- policies affecting gender roles and the status of women; and
- policies in related sectors, such as health, education and the environment that affect populations.

*The POLICY Project is implemented by The Futures Group International in collaboration with Research Triangle Institute (RTI) and the Centre for Population and Development (CEDPA).*

More information about the Spectrum System of Policy Models and the POLICY Project are available from:

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## E. What is AIM ?

The AIDS Impact Model, known as AIM, is a computer program for projecting the impact of the AIDS epidemic. It can be used to project the future number of HIV infections, AIDS cases, and AIDS deaths, given an assumption about adult HIV prevalence. It can also project the demographic and social development impacts of AIDS. These projections then can be used in graphic policy presentations intended to enhance knowledge of AIDS among policymakers and to build support for effective prevention and care.

The Futures Group International, in collaboration with Family Health International, prepared the first version of AIM in 1991 under the AIDS Technical Support (AIDSTECH) and AIDS Control and Prevention (AIDSCAP) projects. A revised version was released in 1995. Since 1991, AIM has been applied in a number of countries in Africa, Latin America, and Asia.

*The* Impacts *section of AIM is available in two forms. It can be used as a module with Spectrum or as an Excel spreadsheet. In either case, the projection results are usually transferred to presentation software, such as PowerPoint, for presentation to leadership audiences.*

AIM requires an assumption about the future course of adult HIV prevalence. Assumptions about other HIV/AIDS characteristics can also be entered for such variables as the length of the incubation period, the age and sex distribution of new infections the first year of the epidemic, and the perinatal transmission rate. A demographic projection must be prepared first, before AIM can be used. DemProj, one of the Spectrum system of policy models, is used to make the demographic projection; see the DemProj manual for more information. This projection is modified by AIM through AIDS deaths and the impact of HIV infection on fertility. The *Epidemiology* section of AIM calculates the number of HIV infections, AIDs cases, and AIDS deaths. This information is used in the *Impacts* section to calculate various indicators of demographic and social impact.

*AIM's focus is on generating information useful for policy and planning purposes*

AIM (and the entire Spectrum system of models) is designed to produce information useful for policy formulation and dialogue within a framework of computer programs that are easy to use. The focus is on generating information useful for policy and planning purposes rather than on carrying out detailed research into the underlying processes involved. For this reason, the program is designed to be used by program planners and policy analysts. AIM uses data that are readily available and requires little technical expertise beyond what can be acquired through review and use of this manual.

## F. Why Make HIV/AIDS Projections?

*HIV/AIDS projections can illustrate the magnitude of the AIDS epidemic and the demographic, social and economic consequences.*

A key aspect of the policy process is recognizing that a problem exists and placing that problem on the policy agenda. HIV/AIDS projections can illustrate the magnitude of the AIDS epidemic and the demographic, social and economic consequences. This illustration also can show policymakers the impacts on other areas of development and the size of the impacts that could be expected without effective action.

For most uses, model users will require several alternative HIV/AIDS projections rather than a single projection, for two reasons. First, projections are based on assumptions about the future levels of fertility, mortality and migration. Because these are uncertain assumptions, it is often wise to consider low, medium and high variants of each of these assumptions so that the range of plausible projections can be determined. Second, when HIV/AIDS projections are used for policy dialogue, it is usually important to show how various assumptions about future rates of HIV prevalence would affect the projections. At a minimum, it is usually useful to prepare one projection that illustrates a likely future course for the epidemic and another that uses the same set of inputs but assumes that there is no AIDS epidemic. In this way, the consequences of the epidemic will be clearly demonstrated.

# II. Steps in Making an HIV/AIDS Projection

*AIM requires a population projection prepared with DemProj. This projection should be prepared first or at the same time as the AIM projection.*

There are six key steps in making most AIM projections. The amount of time spent on each step may vary, depending on the application, but most projection activities will include at least these six steps.

1. **Prepare a demographic projection.** AIM requires a population projection prepared with DemProj. This projection should be prepared first or at the same time as the AIM projection. The first and last years of the DemProj projection will determine the span of the AIM projection. The HIV/AIDS projections will be more accurate if the projection is started at least a year or two before the start of the AIDS epidemic. Thus, if the first year in which HIV was detected in the population was 1981, the first year of the projection should be set to 1979 or 1980. The projection can start in the middle of the epidemic, but in that case the program needs to project in reverse the number and timing of HIV infections that occurred prior to the first year of the projection. This procedure will generally be less accurate than starting the projection before the first year of the epidemic.
2. **Collect data.** At a minimum, AIM requires an assumption about current and future adult HIV prevalence. For many other inputs, default values provided by the program can be used, or country-specific figures can be supplied. Country-specific figures are required to calculate many of the indicators of the impacts of AIDS. Since the projection will only be as good as the data on which it is based, it is worth the effort to collect and prepare appropriate and high-quality data before starting the projection.
3. **Make assumptions.** The full range of AIM indicators requires assumptions about a number of items such as future levels of expenditure per AIDS patient, total health care expenditures, and the number of hospital beds available. These assumptions should be carefully considered and based on reasonable selection guidelines.
4. **Enter data.** Once the base year data are collected and decisions are made about projection assumptions, AIM can be used to enter the data and make an HIV/AIDS projection.

5. **Examine projections.** Once the projection is made, it is important to examine it carefully. This examination includes consideration of the various demographic and HIV/AIDS indicators produced as well as the age and sex distribution of the projection. Careful examination of these indicators can act as a check to ensure that the base data and assumptions were understood and were entered correctly into the computer program. This careful examination is also required to ensure that the consequences of the assumptions are fully understood.

*Once the base projection has been made, the program can be used to quickly generate alternative projections*

6. **Make alternative projections.** Many applications require alternative HIV/AIDS projections. Once the base projection has been made, the program can be used to quickly generate alternative projections as the result of varying one or several of the projection assumptions.

# III. Projection Inputs

AIM requires data describing the characteristics of the HIV/AIDS epidemic, the health care system, and the various economic processes. Some of these data (e.g., adult HIV prevalence) must be specific for the area being studied, whereas others (e.g., perinatal transmission rate) can be based either on local data or on international averages when local data are unavailable. The purpose of this chapter is to describe the inputs required and their possible sources. Recommendations are presented for default values to use when local data are not available. Each of the required variables is discussed below.

## A. Demographic Projection

As noted several times previously, AIM requires that a demographic projection first be prepared using DemProj, another model in the Spectrum system. A complete description of the use of DemProj can be found in the DemProj manual, *DemProj, Version 4, A Computer Program for Making Population Projections*. Model users should keep two key points in mind when preparing a DemProj projection for use with AIM:

*Projections will be more accurate if the projection period includes the start of the epidemic.*

1. The first year of the projection should be before the starting year of the HIV/AIDS epidemic. It is possible to start the projection in a year after the beginning of the AIDS epidemic, but the projections will be more accurate if the projection period includes the start of the epidemic.
2. The life expectancy assumption entered into DemProj should be the life expectancy in the absence of AIDS. The DemProj manual contains several suggestions for making this assumption. AIM will calculate the number of AIDS deaths and determine a new life expectancy that incorporates the impact of AIDS. It is necessary to use this two-step process because model life tables (for specifying the age distribution of mortality) do not contain patterns of mortality that reflect the excess deaths—of young adults and children—caused by AIDS.

## B. Adult HIV Prevalence

### 1. Base Year Estimates

Adult HIV prevalence is the percentage of all adults who are infected with HIV. In AIM, an adult is defined as a person aged 15 or older. Thus, this estimate of prevalence refers to the entire adult population, not just a specific risk group.

HIV prevalence data usually come from blood surveys done among small population groups. In only a few cases have such surveys been done for entire countries (e.g., Uganda in 1987). There are two major sources of surveillance data.

1. **National AIDS Control Program (NACP).** Generally the National AIDS Control Program or the HIV/AIDS unit in the Ministry of Health will be the best source of HIV surveillance information. In many countries, the NACP operates a sentinel surveillance system that regularly conducts surveys in a number of sites around the country. Other ad hoc surveys may be conducted among special populations.
2. **HIV/AIDS Surveillance Database.** The International Programs Center of the US Bureau of the Census maintains an HIV/AIDS surveillance database that contains information from a large number of surveillance studies. The database contains information from published articles, international AIDS conferences, and other sources. The database is distributed both as hard copy and on computer diskette. For more information about the database or to obtain copies, contact:

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*Since AIM requires an estimate of HIV prevalence for the entire adult population, it is rarely possible to use surveillance data directly to make this estimate.*

Surveillance information will generally refer to small populations and various risk groups. Since AIM requires an estimate of HIV prevalence for the entire adult population, it is rarely possible to use surveillance data directly to make this estimate. National estimates are usually based on surveillance data from groups of pregnant women, since they are more representative of the general population than other groups that are typically studied (e.g., patients with STDs [sexually transmitted diseases], commercial sex workers). However, even these data need to be adjusted for several factors, such as age, sex, geographic location, urban/rural residence, sexual activity, etc. Since surveillance data are not usually collected for the purpose of making national estimates, there may be questions about how representative the samples are. Fortunately, there are two sources of national estimates of HIV prevalence.

1. **UNAIDS (the Joint United Nations Programme on HIV/AIDS)**. Periodically UNAIDS prepares estimates of national HIV prevalence for most of the countries of the world. These estimates are based on careful consideration of the available surveillance data, by risk group; recent trends in HIV infection; and national population estimates(Mertens et al., 1995). The 1994 estimates have been published (Mertens and Burton, 1996). More recent updates are available from time to time as special publications from UNAIDS and are also available through the Internet at http://www.hiv.unaids.org.
2. **US Census Bureau.** The US Census Bureau prepares demographic projections for all the countries in the world every two years. These projections include the impact of AIDS for the most severely affected countries. In order to make these projections, they first estimate national HIV prevalence using surveillance data from their HIV/AIDS database. These estimates are published in the documents reporting the population projections. The latest publication of the World Population Profile was in 1996. Earlier estimates and a detailed description of the methodology are available in *The Impact of HIV/AIDS on World Population*. Both publications are available from Population Studies Branch, International Programs Center, Population Division, US Bureau of the Census, Washington, DC 20233-8860, Fax: 301-457-1539, e-mail: prowe@census.gov. It should be noted that the Census Bureau estimates report HIV prevalence among adults aged 15 to 49. For use in AIM, they need to be adjusted to correspond to all adults aged 15 or older.

## 2. Future Projections

An AIM projection requires an estimate of future levels of HIV prevalence. Usually AIM is used to illustrate the future consequences of an epidemic. Therefore, it is not necessary to try to *predict* future prevalence. Rather, AIM can be used with plausible projections of future prevalence to show what would happen if prevalence followed the indicated path. In this case it is only necessary to have a plausible projection.

*When AIM is used to stimulate policy dialogue, it is often helpful to use a conservative projection of future prevalence.*

When AIM is used to stimulate policy dialogue, it is often helpful to use a conservative projection of future prevalence. This approach will avoid charges that the presentation is using the worst possible assumptions to make the case for AIDS interventions stronger and will allow the discussion to focus on other, more important issues.

Various approaches and tools outside of the Spectrum system are available to make HIV prevalence projections. The following sections describe several of these approaches. No matter which is used, all the AIM calculations rely on the assumption of future HIV prevalence. Care should be used to develop reasonable assumptions, and the effects of alternative assumptions should be examined.

### *EpiModel*

There is a separate computer program, called EpiModel, that facilitates the development of an HIV prevalence estimate and calculates the number of infections, AIDS cases and AIDS deaths resulting from that projection. EpiModel was produced by Dr. James Chin, now at the University of California at Berkeley. The program and manual are available from the AIDSCAP project (AIDSCAP, Family Health International, 2101 Wilson Blvd., 7th Floor, Arlington, VA 22201, USA, telephone 703-516-9779). EpiModel projects the past and future course of an AIDS epidemic based on three key assumptions: the year in which HIV infection first became widespread, the number of people alive with HIV infection in a recent year, and the shape of the infection curve. The model allows the user to select a curve type to describe cumulative HIV infections over time. Most projections assume a gamma curve (a type of S-shaped curve). A gamma curve is fitted to two points: (1) zero infections the year before HIV infection became well established in a core group, and (2) the current estimate of infections. The user decides where on the gamma curve the current year lies. If the user decides that the epidemic is still in its early stages, then the point representing the current year is placed in the early part of the S-curve, leaving the most rapid increase in infections to occur in the future. If the user decides that HIV incidence is currently at its peak, then the current year estimate is placed right in the middle of the S-curve. Similarly, if it is assumed that the epidemic has reached the endemic stage, then the current year estimate is placed near the top of the S-curve. Thus, the assumption about the current stage of the epidemic largely determines the future projection.

While EpiModel does not produce an automatic projection of future prevalence, it does make it easier for users to prepare such an estimate.

### *AIDSproj*

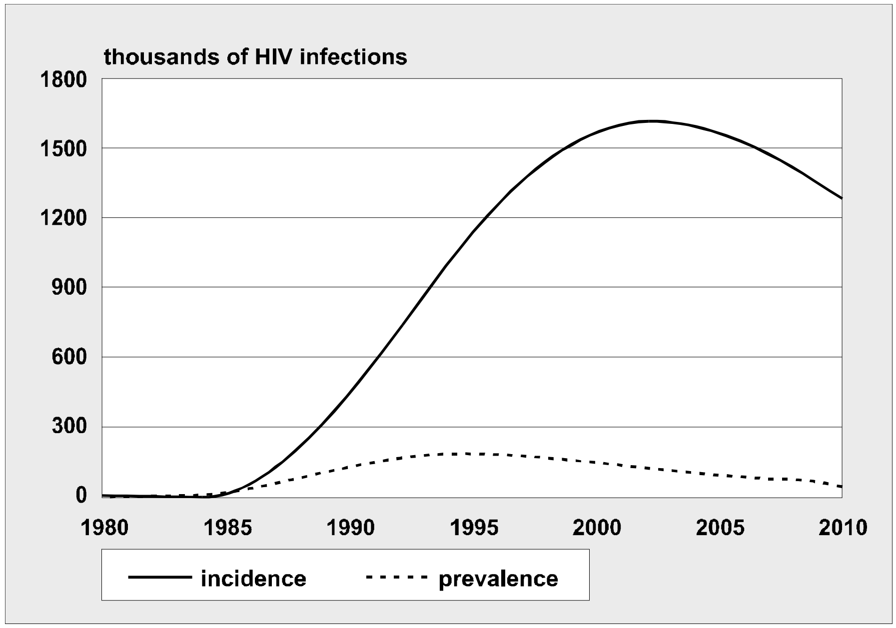
AIDSproj is an Excel spreadsheet developed by the POLICY Project; it has many of the same features as EpiModel. One key difference is that AIDSproj uses as input the prevalence of HIV as a percentage of all adults rather than the number of infections (as in EpiModel). Thus, the projection of future prevalence (expressed as a percentage) does not rely on a population projection. Copies of AIDSproj are available from the POLICY Project and the file can be downloaded from the Internet site of The Futures Group International: http://www.tfgi.com.

### *United Nations Projections*

Like the U.S. Census Bureau, the Population Division of the United Nations prepares population projections for every country in the world every two years. These projections include the impact of AIDS for all countries with adult HIV prevalence above 1 percent. The UN does not publish the prevalence projections used to make these population projections; however, the methodology used by the UN to make the prevalence projections is public. The UN uses EpiModel and assumes that the peak incidence rate, the middle of the gamma curve, is reached 12 years after the beginning of the epidemic.

Figure 1 illustrates how EpiModel might be used to project future incidence and prevalence in Kenya if the number of infections is estimated to be one million in 1994. If information on the size and growth rate of the population is entered, EpiModel can display prevalence as a percentage of all adults, the form required by AIM.

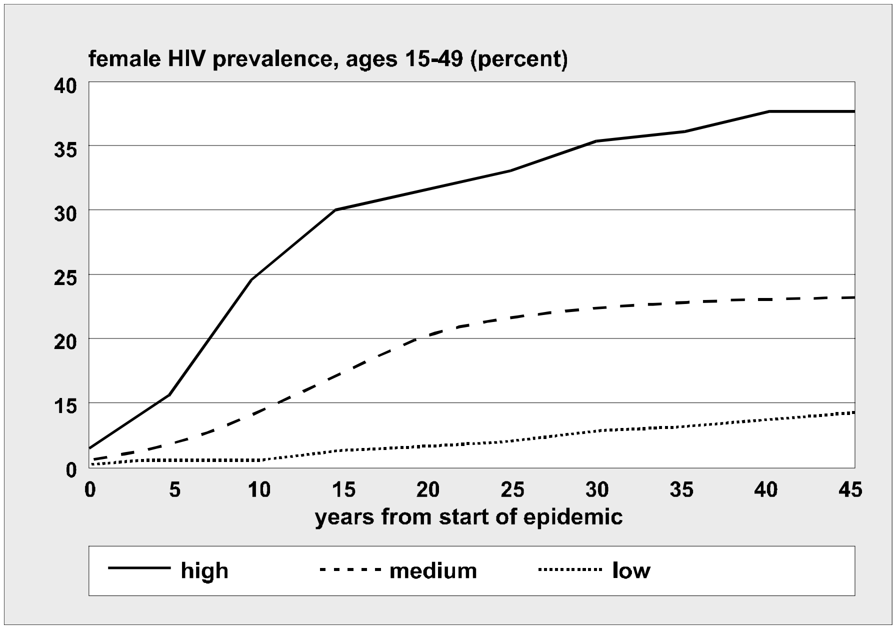
**Figure 1: EpiModel Applied to Kenya**




### *US Census Bureau*

The US Census Bureau approach to projecting HIV prevalence is based on the use of the iwgAIDS (Interagency Working Group on AIDS) model, a complex simulation model of the spread of HIV through a population as a result of the behavior of various population subgroups (Stanley et al., 1989). This model was used to simulate three different African epidemics. In the low scenario, HIV prevalence among adults aged 15-49 increases slowly, reaching only about 5 percent after 45 years. In the medium scenario, prevalence increases to about 17 percent after 35 years and then stabilizes. In the high scenario, prevalence increases to about 37 percent after 45 years. This pattern is illustrated in Figure 2.

**Figure 2: Model Prevalence Projections by US Census Bureau**




In order to project HIV prevalence for an individual country, estimates of prevalence for two historical years are prepared. The rate of increase in prevalence between these two years is compared to the rates of increase in the three simulated scenarios for the corresponding stage of the epidemic. This comparison is used to interpolate a new prevalence curve from the simulated scenarios that best match the historical experience. This interpolated curve provides the prevalence projection. The 1996 round of country-specific projections has not been published, but the projections from the 1994 round have been (Way and Stanecki, 1994).

## C. HIV/AIDS Parameters

There are five special parameters that need to be specified for each AIM projection. They are (1) the start year of the epidemic, (2) the perinatal transmission rate, (3) the percentage of infants with AIDS who die in the first year of life, (4) life expectancy after AIDS diagnosis, and (5) the reduction in fertility related to HIV infection.

### 1. Start Year of the Epidemic

The first year of the epidemic is the year in which the first cases of HIV were detected. This date is generally one or two years before the first AIDS cases were reported. If the AIM projection starts before the first year of the epidemic (the recommended approach), then the start year of the epidemic is not required. If the AIM projection starts after the start year of the epidemic, then AIM uses this information to project in reverse the number of infections (to make an estimate of when past infections were acquired). Since this is the only purpose of this parameter, great precision is not required. The UN estimates of the beginning of the AIDS epidemic, by region, are shown in Table 1.

**Table 1: Start of AIDS Epidemic, by Region**

| Region | Start of Epidemic |
|---|---|
| Sub-Saharan Africa | Late 1970s - early 1980s |
| South and Southeast Asia | Late 1980s |
| Latin America | Late 1970s - early 1980s |
| North America, Western Europe, Australia, New Zealand | Late 1970s - early 1980s |
| Caribbean | Late 1970s - early 1980s |
| Central Europe, Eastern Europe, Central Asia | Early 1990s |
| East Asia, Pacific | Late 1980s |
| North Africa, Middle East | Late 1980s |

**Source:** *HIV/AIDS: The Global Epidemic,* UNAIDS and WHO, 1996.

### 2. Perinatal Transmission Rate

The perinatal transmission rate is the percentage of babies born to HIV-infected mothers who are infected themselves. Studies have found that this percentage ranges from about 13 to 32 percent in industrialized countries and 25 to 48 percent in developing countries (Bryson, 1996; Dabis et al., 1993). The higher rates have generally been found in studies in Africa, where a significant amount of transmission through breastfeeding may take place, and the lower figures have been found in Western Europe. AIM uses a default value of 35 percent, typical of developing countries. If country-specific studies are available, this figure can be changed by the user.

### 3. Percentage of Infants with AIDS Dying in the First Year of Life

AIM uses a distribution of the incubation period (discussed below) to calculate the number of people progressing from HIV infection to AIDS. This information can be used to calculate the number of infants infected perinatally that develop AIDS at each age. In order to calculate the impact on the infant mortality rate, it is necessary to know how many infants who develop AIDS die before their first birthday. This percentage is only used to determine the impact on the infant mortality rate; it does not affect any other aspect of the projections. The default value in AIM is 67 percent and should be used unless some country-specific information is available.

The impact of this factor on the infant mortality rate depends on the incubation period for children. If the incubation period assumptions specify that 25 percent of HIV-positive children develop AIDS in the first year of life, then using the default value for this parameter means that 16 percent (25 x 0.67) of infected infants will die before their first birthday. If the incubation assumption is higher or lower, then the percentage dying as infants will also change.

### 4. Life Expectancy After AIDS Diagnosis

Life expectancy after AIDS diagnosis is the average number of years a person will live after developing AIDS. In the developing world, this period ranges from six to 18 months. The default value in AIM is one year. Changes in this parameter generally have little effect on the overall projections.

### 5. Percent Reduction in Fertility for HIV-Positive Women

*It is not clear how the total fertility rate might be affected by an HIV/AIDS epidemic.*

It is not clear how the total fertility rate might be affected by an HIV/AIDS epidemic. Some women who find that they are infected with HIV may want to have as many children as possible while they can, in order to leave descendants behind. Others may decide to stop childbearing upon learning that they are HIV positive in order to avoid leaving motherless children behind. Since the majority of people do not know if they are infected or not, knowledge of HIV infection is not likely to have a large effect on the desired fertility rate .

Age at marriage may also be affected and could, in turn, affect fertility rates. AIDS could lead to a lower age at marriage or first union if young women and their parents seek early marriage as a protection against the young woman having premarital sex with a number of different partners. This trend, in turn, could raise fertility rates if women are exposed longer to the possibility of pregnancy. Conversely, AIDS could lead to higher age at first intercourse as the dangers of unprotected sex become known. This trend would lead to lower fertility rates.

Gregson and colleagues have examined the question of the impact of HIV on fertility by examining potential changes in the proximate determinants of fertility (Gregson, 1994; Gregson et al., 1997). They found no clear evidence either way but concluded that the most likely result is that an HIV epidemic will slightly reduce fertility.

A recent study in Tanzania found weak evidence that adult mortality due to AIDS leads to reduced fertility rates (Ainsworth, Filmer and Semali,1995). Two recent studies in Uganda found that HIV-infected women had lower fertility rates than HIV-negative women. One of these, in rural Rakai district (Gray et al., 1997), found that age-specific fertility rates for HIV-infected women were 50 percent less than those for women who were not infected. Another study among a rural population in Masaka (Carpenter et al., 1997), found that fertility rates were 20 to 30 percent lower among HIV-infected women. Since most women did not know their sero-status, the reduced fertility rates were most likely due to biological rather than behavioral factors. This finding suggests that fertility might be 20 to 50 percent lower among HIV-infected women. In societies with substantial use of contraception, there might be a reduction in contraceptive use that would partially compensate for this effect.

In a country with a relatively high HIV prevalence rate of 10 percent among adults, a 50 percent reduction in fertility among HIV-infected women would translate into a 5 percent reduction in fertility due to HIV infection.

The default value in AIM is 30 percent. Users can change this figure to country-specific values that may be available, or investigate the impact of this factor.

## D. Incubation Period

*The incubation period describes the amount of time that elapses from the time a person becomes infected with HIV until he or she develops AIDS.*

The incubation period describes the amount of time that elapses from the time a person becomes infected with HIV until he or she develops AIDS. AIM uses the cumulative distribution of the incubation period. This distribution is defined as the cumulative proportion of people infected with HIV who will develop AIDS, by the number of years since infection. For example, it might be that for all people infected in a certain year, 1 percent will develop AIDS within one year; 3 percent will develop AIDS within two years; 7 percent within three years; etc. The incubation period can be specified for up to 20 years. The cumulative percentage developing AIDS by year 20 will be the percentage that ever develops AIDS. Thus, if this value is equal to 95 percent, it implies that 5 percent of people infected with HIV will never develop AIDS. AIM uses separate incubation distributions for adults and children.

### 1. Adult Incubation Period

A number of studies have calculated the distribution of the incubation period for different groups of adults (Alcabes et al., 1994; Buchbinder et al., 1994; 1996; Chevret et al, 1992; Chiarotti et al., 1994; Downs et al., 1991; Hendriks et al., 1992, 1993; Hendriks, Satten et al., 1996; Law, 1994; Operskalski et al., 1995; Veuglers, 1994). Estimates of the median time from infection to AIDS range from 6.5 to 16.1 years, with most of the estimates at 9-10 years. Estimates of the mean time to AIDS generally are slightly longer. Differences are due to a variety of factors. Progression to AIDS occurs faster in older people and in those infected through male homosexual contact. Aside from these factors, the mode of infection does not seem to affect the progression to AIDS.

Most of the studies of progression to AIDS have been done in industrialized countries. Very little information is available from developing countries. The little information that is available indicates that progression to AIDS may occur more rapidly than in industrialized countries, possibly due to poorer health status among the infected population.

AIM has three default progression patterns available: fast, medium and slow. These are shown in Table 2 and Figure 3. The user can select one of these patterns using the appropriate button or enter a custom pattern directly.

**Table 2: Cumulative Proportion Developing AIDS, by Time Since Infection, for Adults**

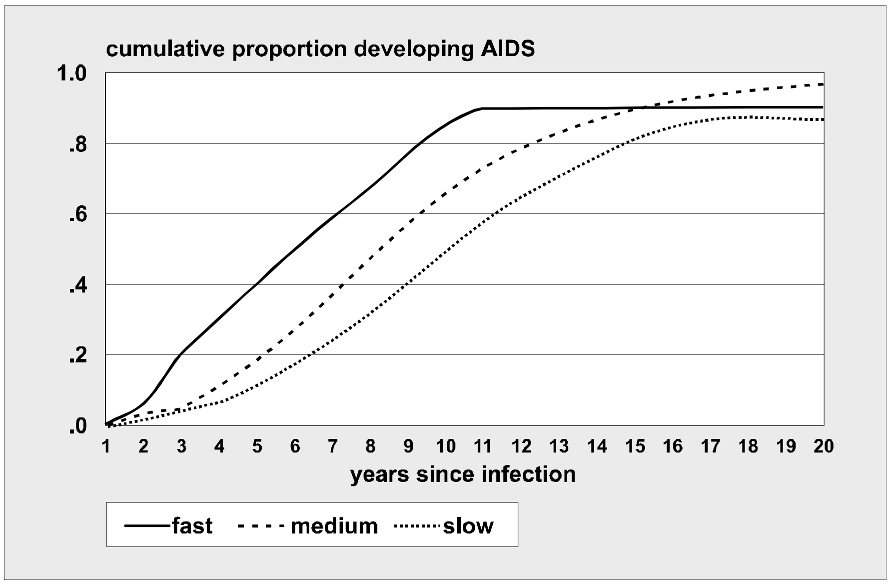
| Years Since Infection | Fast | Medium | Slow |
|---|---|---|---|
| | Median = 6 Years | Median = 8 Years | Median = 10 Years |
| 1 | 0.00 | 0.00 | 0.00 |
| 2 | 0.06 | 0.03 | 0.01 |
| 3 | 0.20 | 0.05 | 0.04 |
| 4 | 0.30 | 0.11 | 0.07 |
| 5 | 0.40 | 0.18 | 0.11 |
| 6 | 0.50 | 0.28 | 0.17 |
| 7 | 0.59 | 0.37 | 0.24 |
| 8 | 0.68 | 0.47 | 0.32 |
| 9 | 0.77 | 0.58 | 0.41 |
| 10 | 0.86 | 0.66 | 0.50 |
| 11 | 0.90 | 0.73 | 0.58 |
| 12 | 0.90 | 0.79 | 0.65 |
| 13 | 0.90 | 0.83 | 0.71 |
| 14 | 0.90 | 0.87 | 0.76 |
| 15 | 0.90 | 0.90 | 0.82 |
| 16 | 0.90 | 0.92 | 0.85 |
| 17 | 0.90 | 0.94 | 0.87 |
| 18 | 0.90 | 0.95 | 0.87 |
| 19 | 0.90 | 0.96 | 0.87 |
| 20 | 0.90 | 0.97 | 0.87 |

The slow pattern has a median time from infection to AIDS of 10 years. It is based on the data from the San Francisco City Clinic Cohort, which comprises gay and bisexual men (Buchbinder et al., 1996).

The medium pattern has a median time from infection to AIDS of approximately eight years. It is based on data from an Amsterdam cohort of gay and bisexual men (Hendriks, 1996).

The fast pattern has a median time from infection to AIDS of six years. It is not based on a cohort study but was constructed by James Chin and is used in EpiModel (Chin, 1996).

**Figure 3: Cumulative Progression From HIV Infection to AIDS**




## 2. Child Incubation Period

Children who are infected perinatally generally progress to AIDS faster than adults. Studies have reported median time from birth to AIDS to range from one year to 6.3 years (Auger et al., 1988; Commenges et al., 1992; Downs, Salamini, and Ancella Park, 1995; Jones et al., 1989; Lui et al., 1988; Oxtaby et al., 1992; Pliner, Weedon, and Thomas, 1996; Salamini et al., 1992;). Several of these studies have found that some children (perhaps 40%) progress to AIDS within a few months while the rest take considerably longer.

AIM has three default progression patterns available for children: fast, medium and slow. These are shown in Table 3 and Figure 4. The user can select one of these patterns using the appropriate button or enter a custom pattern directly.

The slow pattern has a median time from birth to AIDS of 6.2 years. It is based on the data from the New York City Perinatal HIV Transmission Collaborative Study (Pliner, Weedon, and Thomas, 1996).

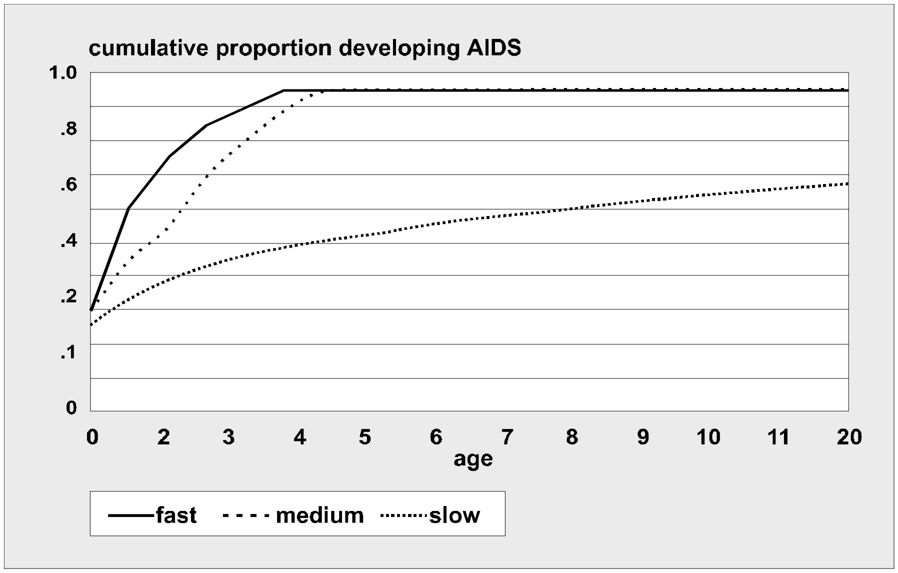
The medium pattern has a median time from infection to AIDS of 2.5 years. It is based on data from a New York City study (Auger et al., 1988).

The fast pattern has a median time from infection to AIDS of 1.5 years. It is based on data collected from 1984 to 1990 at the Centre Hospitalier de Kigali in Rwanda (Commenges et al., 1992).

**Table 3: Cumulative Proportion Developing AIDS, by Time Since Birth, for Children**

| Years Since Birth | Fast | Medium | Slow |
|---|---|---|---|
| | Median = 1.5 Years | Median = 2.5 Years | Median = 6.2 Years |
| 1 | 0.29 | 0.30 | 0.25 |
| 2 | 0.62 | 0.45 | 0.34 |
| 3 | 0.75 | 0.55 | 0.39 |
| 4 | 0.85 | 0.70 | 0.43 |
| 5 | 0.90 | 0.80 | 0.47 |
| 6 | 0.95 | 0.90 | 0.49 |
| 7 | 0.95 | 0.95 | 0.51 |
| 8 | 0.95 | 0.95 | 0.53 |
| 9 | 0.95 | 0.95 | 0.55 |
| 10 | 0.95 | 0.95 | 0.57 |
| 11 | 0.95 | 0.95 | 0.58 |
| 12 | 0.95 | 0.95 | 0.59 |
| 13 | 0.95 | 0.95 | 0.60 |
| 14 | 0.95 | 0.95 | 0.62 |
| 15 | 0.95 | 0.95 | 0.63 |
| 16 | 0.95 | 0.95 | 0.64 |
| 17 | 0.95 | 0.95 | 0.65 |
| 18 | 0.95 | 0.95 | 0.66 |
| 19 | 0.95 | 0.95 | 0.67 |
| 20 | 0.95 | 0.95 | 0.68 |

**Figure 4: Cumulative Progression From Birth to AIDS**




## E. Age and Sex Distribution of New Infections

*In most epidemics, there are more male than female infections early in the epidemic. As the epidemic matures, the numbers become more nearly equal.*

This input is the distribution by age and sex of all new HIV infections in a particular year. The figures should add to 100 across both sexes. That is, male infections might account for 60 percent of all infections and female infections for the remaining 40 percent. In most epidemics, there are more male than female infections early in the epidemic. As the epidemic matures, the numbers become more nearly equal. This pattern is especially noticeable in areas such as the Caribbean and Latin America, where the early infections were primarily among homosexual and bisexual men and the epidemic later spread to male and female heterosexuals. However, even in epidemics that are primarily heterosexual, there are usually more male than female infections in the early stages.

Data on the age and sex distribution of new infections are not easy to obtain. Prevalence surveys measure the cumulative infections, not new infections, and they are usually done only among special population groups.

In most cases the best way to estimate the distribution of new infections is from reported AIDS cases. Although AIDS cases are usually underreported, they may be useful for examining the distribution of cases by age and sex—unless there is some reason to suspect strong age or sex biases in reported cases. Since AIDS cases are a reflection of infections that occurred 5 to 10 years earlier, it is necessary to adjust the figures for this time lag. Thus, the distribution of new AIDS cases reported in

1995 should be used to determine the distribution of new infections in 1985 or 1990, depending on the assumed length of the incubation period. The age groups also need to be adjusted for this time lag. For example, if 10 percent of new AIDS cases in 1995 occurred to women in the 25-29 age group and the median incubation period is assumed to be five years, then 10 percent of new HIV infections probably occurred among women aged 20-24 (five years younger) in 1990 (five years earlier).

In many countries there is a bias in health care. For a variety of reasons, men may have more access to *curative* health care than women. If this is the case, then reported AIDS cases will also be biased. In such instances, it may be necessary for users to adjust the male-to-female ratio of reported AIDS cases when estimating the distribution of new infections.

AIM uses a default distribution based on a typical pattern for countries in east and southern Africa. Users elsewhere should develop a different distribution for their application if possible, since the distributions are likely to be quite different in other regions of the world. The default distribution is shown in Table 4.

**Table 4: AIM Default Distribution of New HIV Infections, by Age and Sex**

| | Base Year | | Base Year + 5 | | Base Year + 10 | |
|---|---|---|---|---|---|---|
| **Age** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| 0-4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5-9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10-14 | 0.5 | 1.0 | 1.0 | 1.0 | 0.3 | 1.7 |
| 15-19 | 10.0 | 8.0 | 10.0 | 11.0 | 8.0 | 13.0 |
| 20-24 | 12.0 | 9.0 | 12.0 | 10.0 | 9.5 | 13.0 |
| 25-29 | 14.0 | 5.0 | 12.0 | 6.0 | 11.0 | 8.0 |
| 30-34 | 12.0 | 3.0 | 11.0 | 5.0 | 9.0 | 6.0 |
| 35-39 | 6.0 | 2.0 | 6.0 | 3.0 | 5.0 | 3.0 |
| 40-44 | 5.0 | 1.0 | 4.0 | 2.0 | 3.5 | 2.5 |
| 45-49 | 4.0 | 0.5 | 2.0 | 1.0 | 2.0 | 1.0 |
| 50-54 | 3.0 | 0.3 | 1.0 | 0.6 | 1.0 | 0.7 |
| 55-59 | 2.0 | 0.2 | 0.5 | 0.3 | 0.5 | 0.5 |
| 60-64 | 1.0 | 0.0 | 0.3 | 0.1 | 0.1 | 0.3 |
| 65-69 | 0.5 | 0.0 | 0.2 | 0.0 | 0.1 | 0.2 |
| 70-74 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| 75-79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 80+ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | 70.0 | 30.0 | 60.0 | 40.0 | 50.0 | 50.0 |

## F. Health Sector Impacts

*AIM can also calculate some of the impacts of AIDS on the health sector. For comparison purposes, it can also project the number of child cases of malaria and measles.*

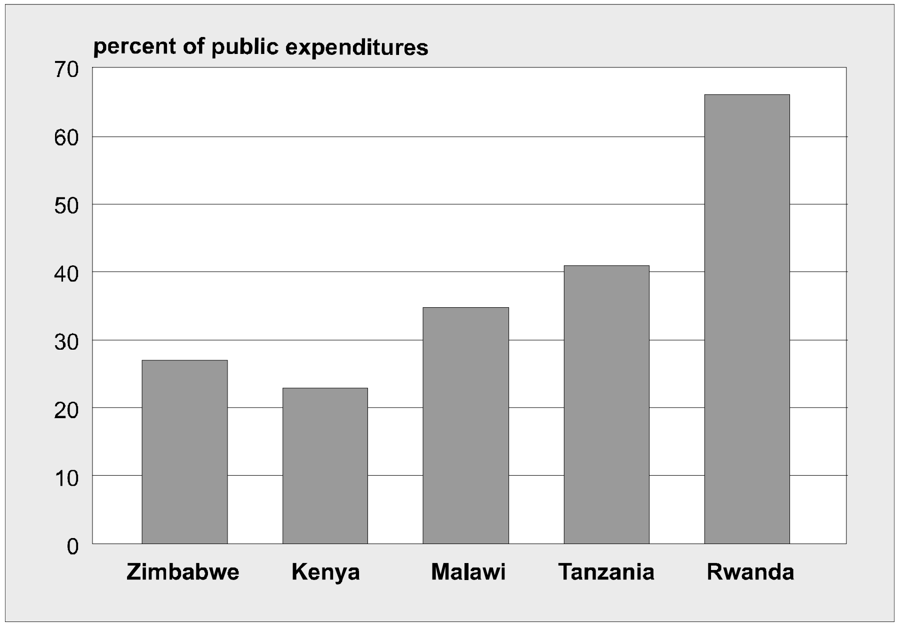
In addition to projecting the number of infections, AIDS cases and deaths, AIM can also calculate some of the impacts of AIDS on the health sector.

As one illustration of the health sector impacts, AIM can display the proportion of all hospital beds that will be occupied by AIDS patients, given an assumption about the average length of hospitalization for AIDS patients. Since AIDS patients typically spend more time in hospitals than patients for other diseases, a large proportion of beds may be devoted to AIDS in a country with many AIDS cases.

AIM can also be used to illustrate the effect of AIDS on direct expenditures for medical care and compare these expenditures with total health care spending. AIDS is an expensive disease, and families thus can spend a significant amount on treatment and drugs. The public health care system spends significantly more for the care of AIDS patients than for most other diseases because of lengthy hospital stays. Table 5 shows the average medical care costs for AIDS patients in a number of countries.

Direct spending on AIDS care is much less than it might be since many people with AIDS do not seek care from the public or commercial health care system. Many receive care only from family members or traditional healers. More people may seek professional care for AIDS in the future, however, as new treatments begin to emerge. A World Bank study has estimated the costs of AIDS care if all AIDS patients were to seek hospital care for AIDS and the current expenditure per AIDS patient remained constant. The study found that costs would range from 23 to 66 percent of total public health care expenditure (Figure 5).

**Figure 5: Potential AIDS Treatment Costs as a Share of Total Public Health Expenditures**




**Source**: Ainsworth and Over, 1992.

For comparison purposes, it can also project the number of child cases of malaria and measles. For these calculations to be made, the following inputs are required.

- **Bed-capacity factor:** The average capacity utilization of hospital beds. A capacity factor of 100 percent means that every available bed is always occupied. A factor of 80 means that, on average, each bed is occupied 80 percent of the time during a year.
- **Bed-days/AIDS patient:** The average number of days that an AIDS patient stays in a hospital from diagnosis until death. This may include days spent during several different hospital stays. This figure has been estimated for different countries to range from 15 to 80 days.
- **Expenditure per AIDS patient:** The average direct costs of treating an AIDS patient from the time of diagnosis with AIDS until death. Table 5 presents estimates of the annual per-patient costs of AIDS care for a number of countries for various years from 1990 to 1993. Although the variation from country to country is quite large, in the majority of cases, annual expenditure per patient is around 100 to 200 percent of GNP per capita. AIM requires the extra cost of treating a patient from the time of AIDS until death; however, in countries without extensive treatment of AIDS

patients with combination therapies, the annual and lifetime costs will be similar.

**Table 5: Annual Medical Care Costs for AIDS Care, 1990-1993**

| Country | Medical Care Cost Per Year (US$) |
|---|---|
| Barbados | 4550 |
| Belgium | 21,900 |
| Canada | 25,447 |
| Chile | 1560 |
| France | 25,636 |
| Honduras | 711 |
| Italy | 10,505-27,764 |
| Kenya | 938 |
| Malawi | 210 |
| Mexico | 1430-7350 |
| Netherlands | 19,000 |
| New Zealand | 18,230 |
| Puerto Rico | 24,200 |
| Rwanda | 358 |
| South Africa | 1850-11,800 |
| Spain | 25,400-27,800 |
| Switzerland | 57,000 |
| Tanzania | 290 |
| Thailand | 658-1015 |
| United Kingdom | 28,200 |
| United States | 33,168 |
| Zambia | 396 |

**Source**: Mann and Tarantola, 1996, p. 392.

- **Hospital beds:** The number of hospital beds available from public, private and NGO facilities.
- **Malaria case fatality rate:** The proportion of disease episodes that end in death. The US Centers for Disease Control and Prevention (CDC) estimates that in sub-Saharan Africa, about 1 percent of episodes are severe and that the mortality rate for severe cases is 25 percent. Thus, the case fatality rate there is 0.0025.
- **Malaria episodes/person/year:** The average number of episodes of malaria per year per child under the age of five. The CDC estimates that this rate is approximately three to six for sub-Saharan Africa.
- **Measles case fatality rate:** The proportion of children with measles who die from measles. The CDC estimates this value worldwide to be about 0.01 to 0.05.
- **Measles vaccine efficacy:** The proportion of children vaccinated against measles who will be protected by the

vaccine. The CDC estimates the vaccine efficacy to be about 80 percent.

- **Ministry of Health budget:** The total annual budget of the Ministry of Health. This figure is used to compare total public health expenditures with the expenditures on AIDS.
- **Percent AIDS hospitalized:** The percentage of people with AIDS who actually seek hospital care. The ratio of reported AIDS cases to estimated actual cases may provide a guide to the percentage that seek hospital care.
- **Percent pop with latent TB:** The percentage of the adult population that harbors the *Mycobacterium tuberculosis* pathogen without developing tuberculosis. In sub-Saharan Africa, this rate is generally assumed to be around 50 percent.
- **Prop. 0-5 vaccinated for measles:** The proportion of children under five who are vaccinated against measles.
- **TB incidence with HIV (%):** The proportion of people with both TB infection and HIV infection who develop TB each year. Estimated to be 2.3 to 13.3 percent (Cantwell and Binkin, 1997).
- **TB incidence without HIV (%):** The expected adult incidence (per thousand) of tuberculosis each year in the absence of HIV infection. Estimated to be about 2.4 per thousand in Africa.

## G. Macroeconomic Impacts

The Excel version of AIM contains a section that illustrates the macroeconomic impacts of AIDS, which are difficult to assess. Since the full costs of AIDS may not be realized until 20 to 30 years after the peak in AIDS deaths, few studies have attempted to assess the macroeconomic impacts of AIDS today. There are studies that examine various components of that impact, such as the increase in health care expenditure. Other studies have used computer simulation models to project the future impact of the epidemic. The following pages summarize the evidence from many of these studies.

### 1. Effects on Labor Force

AIDS leads to the loss of workers in their most productive ages. A serious epidemic can cause the loss of a significant proportion of the trained labor force. An Inernational Labor Organization (ILO) study estimated that AIDS might cause the labor force in Tanzania to be 20 percent smaller by 2010 than it would have been without AIDS (ILO, 1995). Most of this reduction will be caused by experienced workers dying at ages 30 through 50.

In Malawi, the average period of employment is 25.3 years, but for those who are HIV-infected, it is only 9.7 years. Thus, each HIV adult infection causes the loss of 15.6 years of productive employment (Forsythe, 1992).

In the mining sector of Zambia, AIDS deaths have severely affected the trained professional workforce, leading to increased equipment breakdowns, accidents, and delays (Hanson, 1992). In the banking sector in Zambia a loss of trained bankers has led to the closing of a number of branch offices (Whiteside and Stover). Among agricultural workers on a sugar estate, 50 percent of absenteeism was due to HIV and tuberculosis.

The Confederation of Zimbabwe Industries (CZI) has estimated that the cost of replacing employees lost because of AIDS may eventually rise as high as 8 percent of GDP (*Southern African Economist, 1997*).

A survey in higher learning institutions in Swaziland found that almost 20 percent of students were infected with HIV. Most of them will die within 10 years of graduation. Thus, AIDS will reduce the number of trained people entering the labor force and reduce the positive macroeconomic benefits of investment in education (*Southern African Economist, 1997*).

### 2. Macro Models

Most studies have found that estimates of the macroeconomic impacts of AIDS are sensitive to assumptions about how AIDS affects savings rates and whether it affects the best-educated employees more than others. Few studies, however, have been able to incorporate the impacts at the household and firm level into macroeconomic projections.

Some studies have found that the macroeconomic impacts may be small, especially if there is a plentiful supply of excess labor and worker benefits are small. Other studies have found significant macroeconomic impacts. Studies in Tanzania, Cameroon, Zambia, Swaziland, Kenya and other sub-Saharan African countries have found that the rate of economic growth could be reduced by as much as 25 percent over a 20-year period.

An important study by Mead Over of the World Bank examined the macroeconomic impact of AIDS in 30 sub-Saharan African countries (Over, 1992). This study concluded that:

- If the only effect of AIDS is to reduce the size of the labor force, then the growth rate of GDP per capita will increase.
- If HIV prevalence is higher among the better-educated workers (their higher income and mobility lead to more casual sexual partners), then the negative effects of productivity losses will lead to a reduction in the growth rate of per capita income.
- If 50 percent of AIDS treatment costs are financed out of savings, then the reduced investment will further depress the economic growth rate.

*The net effect is likely to be a reduction of the annual growth rate of GDP of 0.8 to 1.4 percentage points per year and a 0.3 percentage point reduction in the annual growth rate of GDP per capita.*

A simulation model of the economy of Cameroon was used to examine the effects of AIDS on economic growth through increasing health care expenditures and the loss of human resources (Kambou, Devaraja, and Over, 1993). This model was one of the more detailed ones developed for examining the impact of AIDS. It included three agricultural sectors, five manufacturing sectors, and three service sectors. Labor was divided into three categories: unskilled rural labor, unskilled urban labor and skilled urban labor. The study found three mechanisms through which labor shortages affected the economy:

- AIDS leads directly to a reduction in the number of workers available.
- A shortage of workers leads to higher wages which leads to higher domestic production costs. Higher production costs lead to a loss of international competitiveness, which causes foreign exchange shortages.
- Lower government revenues and reduced private savings (because of greater health care expenditures and a loss of worker income) lead to less investment and slower economic growth.

*The study concluded that the annual growth rate of GDP could have been reduced by as much as two percentage points during the 1987-1991 period because of AIDS.*

A study of the macroeconomic impacts of AIDS in Zambia (Forgy and Mwanza, 1994) found that by 2000, the GDP will be 5 to 10 percent lower because of AIDS than it would have been if there were no AIDS affecting the population. The authors concluded that *"…without unprecedented infusions of free* *foreign aid to mitigate the effects of AIDS, the economy of Zambia will suffer considerable damage."*

An assessment of the macroeconomic impacts of AIDS in Tanzania was undertaken by the Government of Tanzania, the World Bank, and the World Health Organization in 1991 (Cuddington, 1992). As part of the assessment, an economic model was used to examine the impacts of AIDS on reduced labor productivity and reduced investment. The study found several important impacts.

- Rising mortality rates will cause the labor force and the population to grow more slowly than before the AIDS epidemic.
- Illness and absenteeism among existing workers and the need to hire replacement workers for those who are too ill to work and who die from AIDS will lead to a reduction in worker productivity.
- Rising health care expenditures will lead to a fall in domestic savings, which will reduce capital investment.
- The overall impacts of AIDS on the macroeconomy will be small at first but will increase significantly over time.

*The study found that total GDP will be 15 to 25 percent smaller in 2010 because of the impact of AIDS.*

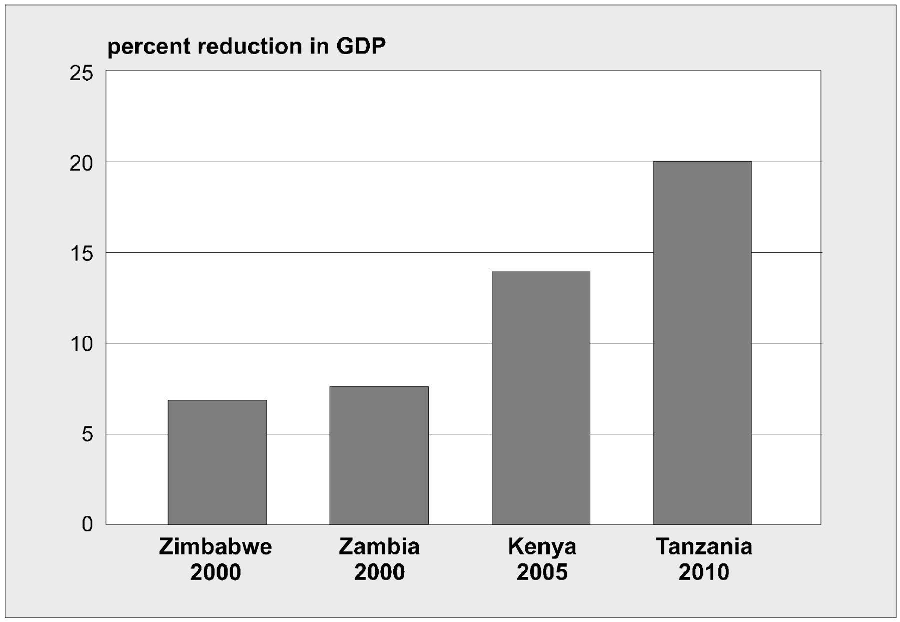
A recent study of the impact of AIDS on the economy of Kenya found that the impact could be substantial in the coming years (Hancock et al., 1996). This study used the MacroAIDS model (Cuddington and Hancock, 1994) to project the impact of AIDS through the year 2005. It found that:

- The increased expenses of medical care for AIDS patients causes a significant drop in savings and capital accumulation. This leads to slower employment creation in the formal sector, which is particularly capital intensive.
- AIDS deaths to workers reduce the experience level of the labor force. The average age of workers drops from 34 to 25 years. This change has a negative effect on worker productivity.
- Reduced worker productivity and investment will lead to fewer jobs in the formal sector. As a result some workers will be pushed from high-paying jobs in the formal sector to lower-paying jobs in the informal sector.
- The amount of capital available per worker may actually rise somewhat in the formal sector due to the loss of jobs, but it will decline in the informal sector.

*As a result of these interactions, GDP will be 14 percent lower in 2005 than it would have been without AIDS. GDP per capita will be 10 percent less in 2005.*

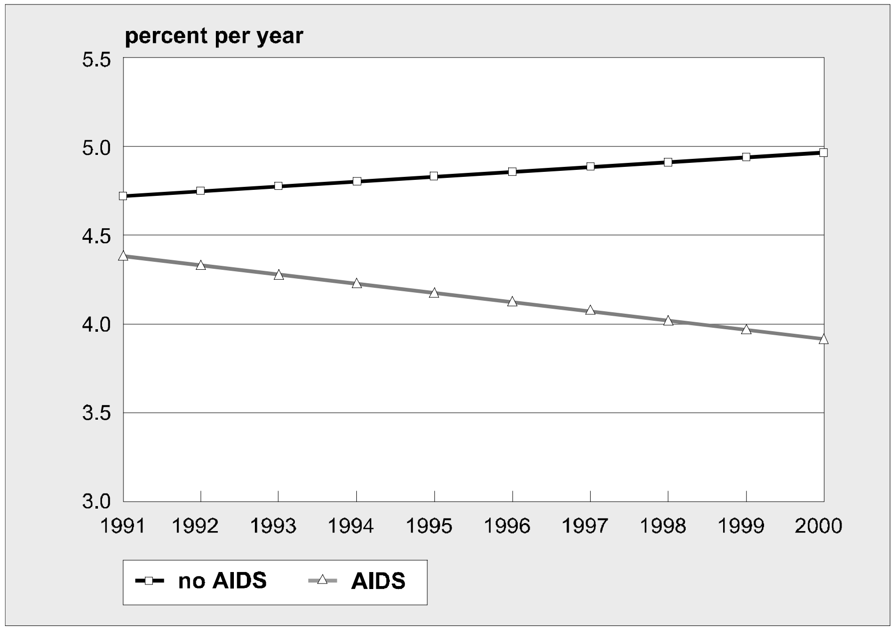
Figure 6 summarizes the reductions on GDP for four of the countries examined above.

**Figure 6: Percent Reduction in Future GDP as a Result of AIDS: Projections from Various Studies**




A computer simulation study of the impact of AIDS in Zimbabwe found that AIDS could lead to a serious reduction in economic growth rates and a large increase in the government deficit. This study found that the annual growth rate of GDP might be 25 percent lower by 2000 than it would have been without AIDS (Figure 7).

**Figure 7: Projection of Annual Economic Growth Rates in Zimbabwe**




**Source**: Forgy, 1993.

### 3. Inputs

The Excel version of AIM includes a section illustrating the macroeconomic impacts of AIDS. It uses a simple production function that will capture some of the dynamics but not all of the detail of the more complex models described above. The inputs required to use this simple model are shown below.

- Labor force participation rate: The percentage of the population between the ages of 15 to 64 that is in the labor force. This figure is usually available from national statistical yearbooks or the Ministry of Labor.
- Base year GDP. The size of the gross domestic product, in millions of currency units, in the base year of the projection. This figure should be available from national statistical yearbooks or from the *World Development Report* or *IMF Statistics*.
- Base year capital stock. The total value of the capital stock (in millions of currency units) in the base year. This figure is often difficult to find. It may be estimated as two to three times the size of the GDP in the base year.
- Average capital lifetime. The average useful lifetime of capital such as infrastructure, buildings, machinery, etc.

This figure may be estimated as 50 years unless better information is available.

- Gross domestic investment as a percent of GDP. The average level of gross domestic investment expressed as a percentage of GDP. This figure can be obtained from national accounts statistics, *World Tables* or *IMF Statistics*.
- Rate of technical progress. The annual rate of growth of GDP that is not due to increases in the size of the labor force or capital stock. These additional increases are assumed to be due to improvements in the quality of the labor force (better education, better management systems) and the quality of capital stock (better technology). The rate of technical progress is calculated as a residual. That is, it is the rate that is required to give the correct growth rate of GDP over some recent historical period given actual growth rates in labor and capital.
- Elasticity of output to labor. The percent increase in GDP that results from a 1 percent increase in the size of the labor force. This figure usually ranges from about 0.3 to 0.7. If the economy has a surplus of labor, then generally the elasticity will be less than 0.5, indicating that larger increases in GDP are to be expected from growth in the capital stock than in the labor force.
- Elasticity of output to capital. The percent increase in the GDP that results from a 1 percent increase in the size of the capital stock. This figure usually ranges from about 0.3 to 0.7. If the economy has a surplus of labor, then generally the elasticity will be greater than 0.5, indicating that larger increases in GDP are to be expected from growth in the capital stock than in the labor force. The sum of the elasticities to labor and capital should be about 1.0. If they sum to 1.0, it means there are constant returns to scale (a 1 percent increase in capital and labor will yield a 1 percent increase in GDP). If they sum to less than 1.0, then there are declining returns to scale.
- Percentage of AIDS care financed from savings. The percentage of direct expenditures for AIDS care that is paid for by foregone savings. Some expenditure for AIDS care will come from reallocating consumption expenditures and some will cause a reduction in savings. The larger the amount financed from savings, the larger the impact is likely to be on GDP growth.

# IV. Projection Outputs

AIM will calculate and display a number of indicators grouped under the headings E*pidemiology* and *Impacts*. A complete list of indicators available and their definitions is given below.

## A. Epidemiology

- **Adult HIV incidence:** The percentage of uninfected adults who become infected in each year.
- **Adult HIV prevalence:** The percentage of adults (population aged 15 and older) who are infected with HIV.
- **AIDS age distribution:** The number of people alive with AIDS, by age and sex. This information can be displayed as a table or a pyramid chart.
- **AIDS deaths:** The annual number of deaths due to AIDS.
- **Cumulative AIDS deaths:** The cumulative number of AIDS deaths since the beginning of the projection.
- **HIV age distribution:** The number of infected people, by age and sex. This information can be displayed as a table or a pyramid chart.
- **HIV/AIDS summary:** A table with all the above indicators shown for a selection of years. All input assumptions are also shown on this table.
- **New AIDS cases:** The annual number of new AIDS cases.
- **Number infected with HIV:** The total number of people who are alive and infected with HIV.

## B. Impacts

- **AIDS care expenditure:** The total annual expenditure on care for people with AIDS.
- **AIDS orphans:** The number of children under the age of 15 whose mothers have died of AIDS.
- **Child measles cases:** The annual number of cases of measles among children under the age of five.
- **Child measles deaths:** The annual number of deaths due to measles among children under the age of five.

- **Hospital bed-days needed:** The number of hospital bed-days needed for AIDS patients. A hospital bed-day is equivalent to one person occupying one hospital bed for one day.
- **Percent hospital bed-days:** The percentage of total available hospital bed-days that are required for AIDS care.
- **Percent of MOH budget for AIDS:** The percentage of the entire budget of the Ministry of Health spent on AIDS care.
- **TB cases:** The annual number of new tuberculosis cases.
- **Young adult (15-49) deaths:** The total number of annual deaths occurring to adults between the ages of 15 and 49, inclusive.
- **GDP**: The size of the gross domestic product. (Excel version only.)
- **Labor force size**: The number of people in the labor force (Excel version only.)
- **GDP per capita**: The gross domestic product per capita. (Excel version only.)

# V. Program Tutorial: Spectrum Version of AIM

This tutorial covers the key steps in installing and running Spectrum and AIM.[1] It assumes you have an IBM-compatible computer running Windows 3.1 or Windows 95 and that you are familiar with the basic operation of Windows programs and terminology.

## A. Before You Get Started

You will need to collect data and make certain decisions before running the model. For example, you will need to decide the following at the very beginning:

- adult HIV prevalence, expressed in percentages, for the first year(s) of the projection and the goal for the final year
- the start year of the AIDS epidemic
- perinatal transmission rate (PTR); AIM uses a default value of 35 percent
- percentage of infants with AIDS dying in the first year; AIM's default value is 67 percent
- life expectancy after AIDS onset, in years; the default is one year
- reduction in fertility among women who are HIV-positive; the default is 30 percent
- the HIV incubation period for the cumulative percentage of adults and children developing AIDS, by number of years since infection. (users can choose from three patterns: fast, medium, and slow)
- the age and sex distribution of new infections.

Other data that you will need include:

- expenditures per AIDS patient
- percentage of AIDS patients hospitalized
- the Ministry of Health budget
- number of hospital beds
- the hospital bed capacity factor
- the number of hospital bed-days for each AIDS patient

[1] There are two versions of AIM: Spectrum and Excel. The Excel spreadsheet permits the user to customize equations and variables as appropriate for the country and region. A brief tutorial follows in Chapter 6.

- proportion of children under age five vaccinated for measles
- measles vaccine efficiency
- measles case fatality rate
- the number of malaria episodes per person per year
- malaria case fatality rate
- TB incidence without HIV infection, in percentages
- Percentage of the population with latent TB
- TB incidence within the HIV-infected population.

These inputs are all described in Chapter III of this manual.

## B. Installing the Spectrum Program

The Spectrum program is distributed on floppy diskettes; it is also available through the Internet at http://www.tfgi.com/software/software.htm. However, it must be installed on a hard disk before it can be used. Spectrum will run on any computer running Windows 3.1 or Windows 95. It requires about 3MB of hard disk space.

To install the Spectrum program, start by inserting the "Install" diskette into your floppy disk drive.[2]

**For Windows 3.1:** Select "File" from the Program Manager menu, then select "Run." In the dialogue box that appears, type the file name "a:\setup.exe" and press OK. (If the install disk is in floppy disk drive b, then use the file name "b:\setup.exe.") Follow the instructions on the screen to complete the installation.

**For Windows 95:** Select "Start" from the task bar. Then select "Run" from the pop-up menu. In the dialogue box that appears, type the file name "a:\setup.exe" and press Ok. (If the install disk is in floppy disk drive b, then use the file name "b:\setup.exe.") Follow the instructions on the screen to complete the installation.

## C. Creating a New Projection

### 1. Starting the Spectrum Program

To start Spectrum, use one of the following methods:[3]

**In Windows 3.1:**

1. Double click on the Spectrum icon on the desktop, or

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[2] To remove the Spectrum program from your hard disk, run the unwise.exe program located in the Spectrum directory.
[3] The computer screen prototypes in this manual correspond to Windows 95.

2. Use the File Manager to locate the directory "c:\spectrum\," then double click on the file named "spectrum.exe."

**In Windows 95:**

1. Click the "Start" button on the task bar.
2. Select "Programs" from the pop-up menu.
3. Select "Spectrum" from the program menu. Alternatively, you can use Windows Explorer to locate the directory c:\spectrum" and double click on the file named spectrum.exe."

## 2. Opening a Demographic Projection

*Before using AIM, you should use DemProj to prepare a demographic projection. DemProj is part of the Spectrum System of Policy Models; for more information, consult its manual.*

AIM in Spectrum requires a demographic projection prepared with DemProj. In a typical AIM application, the demographic projection calculates all the normal demographic processes (births, deaths, migration, aging). AIM influences the demographic projection by adding a number of AIDS deaths and, possibly, specifying a lower fertility rate because of the effects of HIV infection. All the population figures required by AIM (e.g., size of the adult population) are provided by DemProj. Therefore, before using AIM you should prepare a demographic projection using DemProj. For more information on DemProj, consult the DemProj Manual for Spectrum that is a companion to this one, *DemProj: A Computer Program for Making Population Projections*.

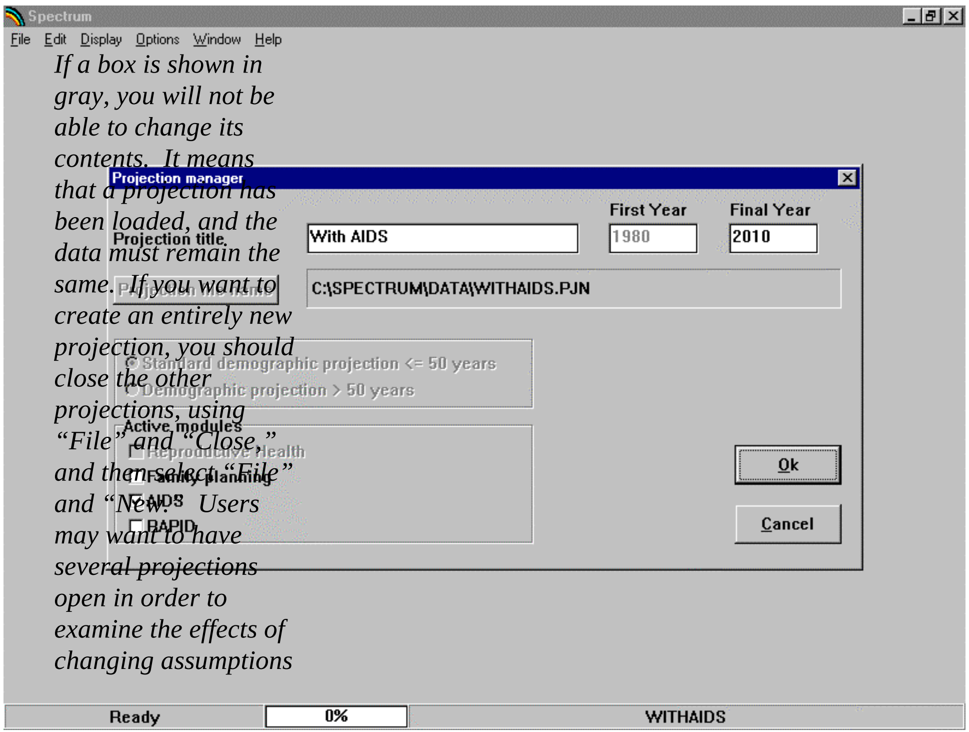
The first step in preparing the AIM projection is to open the demographic projection. To do this,

1. Select "File" from the menu bar.
2. From the pull-down menu that appears, select "Open projection."
3. Select the projection file from the "Open" dialogue box and press "Ok." All pre-existing projections that can be loaded will be listed here.

### 3. Adding the AIM Module to the Projection

Once the demographic projection is open, you need to change the configuration to indicate that the AIDS module will be used as well. To do this, select “Edit” from the menu bar and “Projection” from the pull-down menu.

You will see the “Projection manager” dialogue box. It will look something like the display shown below.




*If a box is shown in gray, you will not be able to change its contents. It means that a projection has been loaded, and the data must remain the same. If you want to create an entirely new projection, you should close the other projections, using “File” and “Close,” and then select “File” and “New.” Users may want to have several projections open in order to examine the effects of changing assumptions*

The following information is displayed.

*Once all the information is entered for this dialogue box, click on the “Ok” button. You can always return to this screen and change some of the information by selecting “Edit” from the menu bar and then “Projection” from the pull-down menu..*

**Projection title:** This title will be printed at the top of all printed output and will be used to identify the projection if more than one projection is loaded at a time. You can change the title to reflect the projection you are about to prepare.

*If you want to change the projection file name, the years, or the demographic projection interval, you will need to do so in DemProj. The options in the Projection manager were set when the demographic projection was created with DemProj.*

**Projection file name:** This is the name that will be used to store all data files associated with this projection. You cannot change the file name here. You can change it if you select "File" and "Save projection as" to save the projection to a new name.

**First year:** This is the first year of the projection.

**Final year:** This is the final year of the projection.

**Demography.** The radio button labeled "standard demographic projection <= 50 years" will be selected by default. You cannot change this here because the demography module is required to make the AIDS projection.

**Active modules.** These radio buttons let you select other modules that will be used with the population projection. Initially none of them will be selected. You should select the "AIDS" module by clicking on the check box next to the name. This step will allow you to include the AIDS module in the projection.

Once all the information is entered for this dialogue box, click on the "Ok" button. You can always return to this screen and change some of the information later by selecting "Edit" from the menu bar and "Projection" from the pull-down menu.

## D. Entering the Projection Assumptions

For readers who feel they need additional review or explanations of the terms found in this section, Chapter III and the glossary of this manual may be useful.

### 1. About the Editors

Both editors in AIM are similar. At the very top of the screen, the variable name appears. At the bottom of the screen are the special edit keys. "Duplicate" allows you to copy information from one cell, column, or row to another; "Interpolate" to enter a beginning and ending number and have the computer calculate the numbers for the intervening intervals; "Multiply" to multiply a cell, column or row by a specific number; and "Source" to write notes indicating the source of the data for future reference.

**To use the "Duplicate" button,**

1. Highlight (select) the range (column, row, or cells to be affected). The first cell in the range should be the value you want to copy.
2. Extend the range to the last year by using the mouse (hold down the left button and drag the range) or the keyboard (hold down the shift key and use the arrow keys).
3. Click on the "Duplicate" key to copy the value at the beginning of the range to all the other cells in the range.

**To use the "Interpolate" button,**

1. Enter the beginning and ending values in the appropriate cells.
2. Highlight the entire range from beginning to end.
3. Click on the "Interpolate" key to have the values interpolated and entered into each of the empty cells.

**To use the "Multiply" button,**

1. Highlight the range (column, row, or cells to be affected).
2. Enter the multiplier in the dialogue box.
3. Click "Ok" to accept. The entire range will be multiplied by the designated number.

**To use the "Source" button,**

1. Click on the "Source" button to open a small word processor window.
2. Enter the source of the data and make any special comments about the assumptions.
3. Click on "Close" to return to the editor.

This feature allows you to keep a record of the data sources and assumptions as you make the projections. This source information will be maintained with the data file and printed whenever you print the projection summary. It is **strongly** recommended that you use this feature to avoid later confusion.

When you have finished entering all the necessary data for the component into the editor,

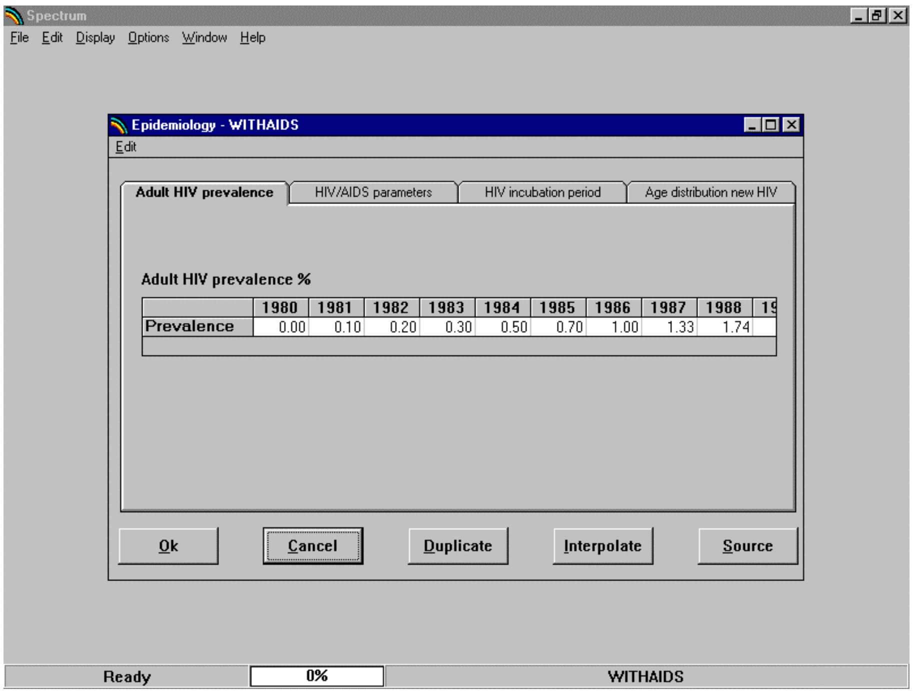
1. Click the "Ok" button to return to the "AIDS" dialogue box.
2. Click the "Close" button to complete the editing process.

The "Cancel" button allows you to exit the editor without making any changes to the data.

## 2. Epidemiology

To enter the assumptions for the AIDS projection,

1. Choose "Edit" from the menu bar.
2. Choose "AIDS (AIM)" from the pull-down menu.
3. Choose "Epidemiology" from the "AIDS" dialogue box. This step will display an editor like the one shown below.




For each of the inputs required for the projection, there is a tab near the top of the screen.

1. To enter data for any of these assumptions, click on the appropriate tab to display the editor for that variable.
2. Then click anywhere inside the editor to make it active.

### *Adult HIV Prevalence*

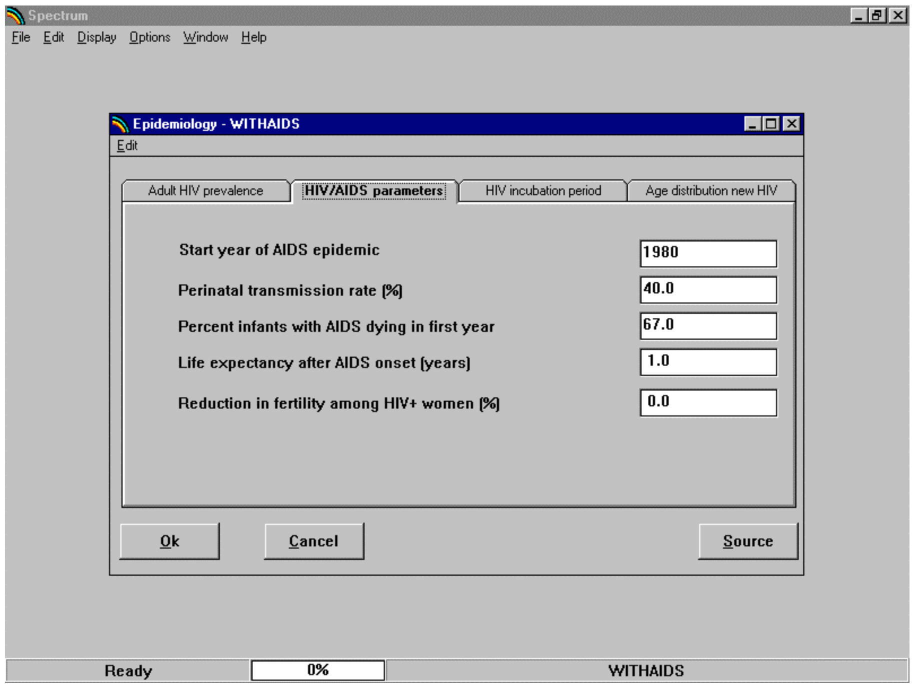
To enter the assumptions for the adult HIV prevalence,

1. Click anywhere inside the editor to make it active.
2. Enter the estimated and projected adult HIV prevalence for each year of the projection. This is the only assumption that must be entered to make an AIM projection.
3. To create a "No AIDS" projection, set HIV prevalence to zero for every year. AIM and DemProj will still make a projection showing what the situation would be if there were no AIDS epidemic.

When you have entered the information on adult HIV prevalence, click the “HIV/AIDS parameters” tab to move to the next editor.

### *HIV/AIDS Parameters*

This editor is used to set the variables for the HIV/AIDS epidemic; users may choose to enter their own data or accept the defaults for all the variables but the start year of the epidemic. It will look similar to the next screen.

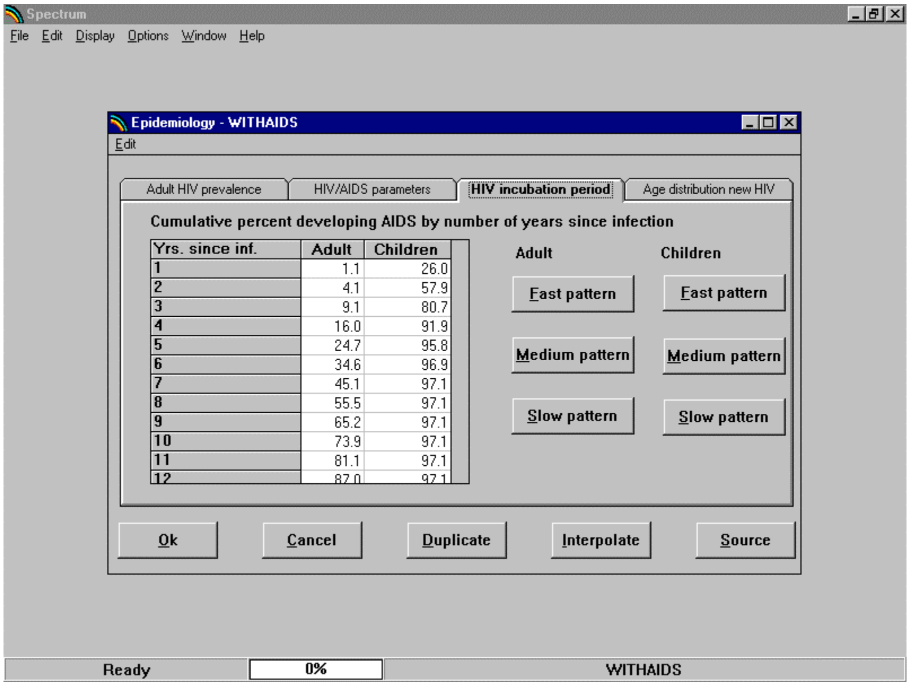



Enter the values for the start year of the epidemic, the perinatal transmission rate, the percentage of infants with AIDS dying in the first year of life, the average life expectancy after AIDS onset, and the percentage reduction in fertility among HIV-infected women. AIM has default values of 35 percent for the perinatal transmission rate; 67 percent for the infants with AIDS dying in their first year; one year average life expectancy after the onset of AIDS; and 30 percent reduction in fertility among HIV-infected women.

When you have entered the information on the HIV/AIDS parameters, click the “HIV/incubation period” to move to the next editor.

### *HIV Incubation Period*

AIM requires a distribution of the incubation period, described as the cumulative percentage of HIV-infected individuals developing AIDS by the number of years since they acquired the infection. The editor for this data entry is shown below.

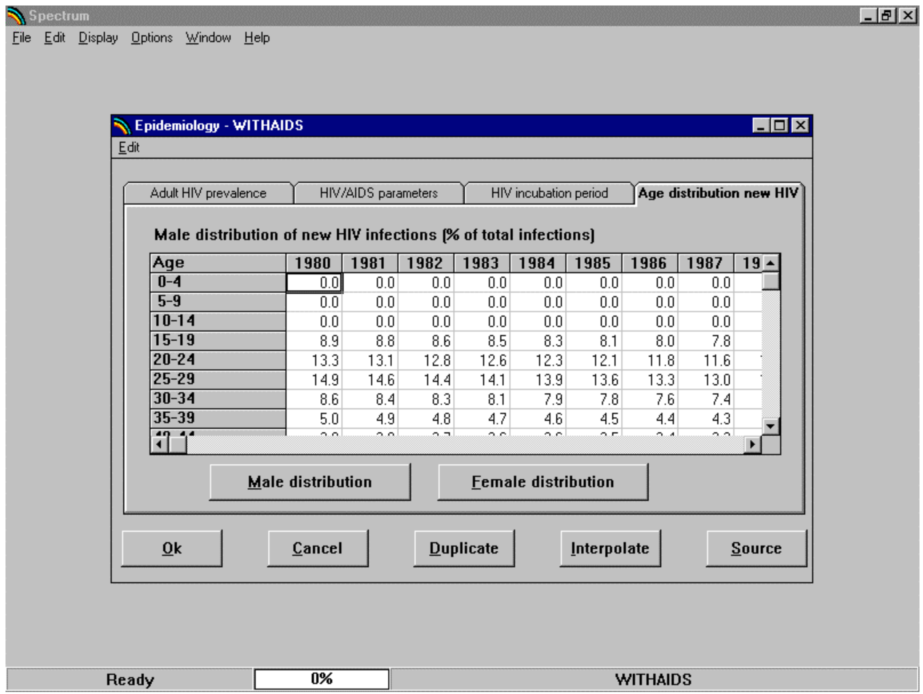



Users may enter their own data or may choose from the default patterns to the right of the editor. These buttons provide several default distributions for both adults and children. Click on the desired option, and the corresponding distribution will be entered into the editor.

When you have entered the information on the HIV incubation period, click the “Age distribution new HIV” tab to move to the next editor.

### *Age Distribution New HIV*

In the editor for the age distribution of new HIV cases, enter the distribution of new HIV infections, by age and sex; see the screen below. When the editor first appears, it shows the table for male infections. You can switch back and forth from male to female by clicking on the appropriate button in the bottom half of the editor. As noted in Section III E, AIM uses a default distribution based on a typical pattern for countries in east and southern Africa. Users elsewhere should develop a different distribution for their application if possible.

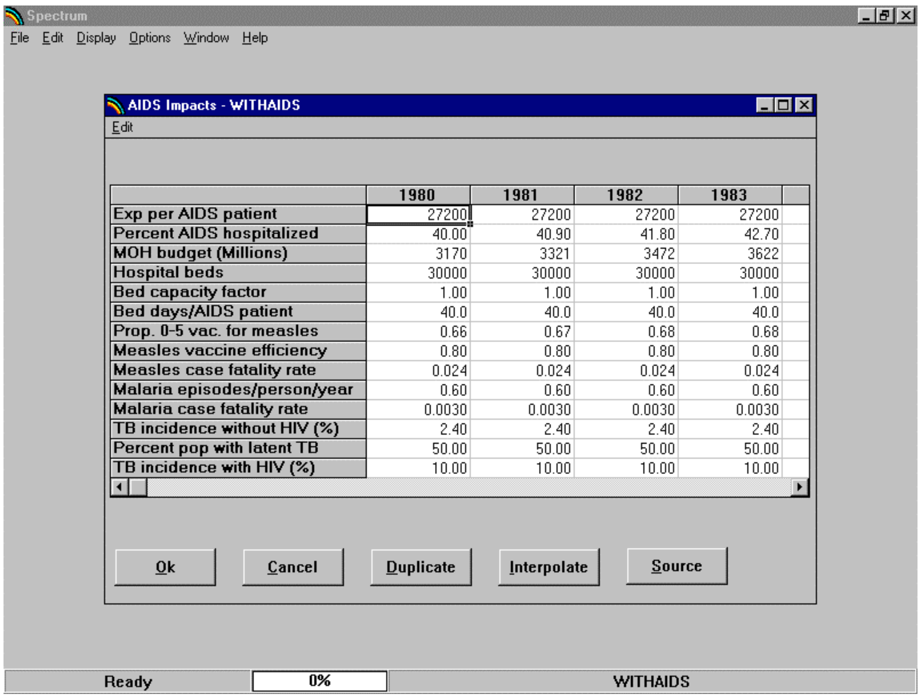



The distribution for each year must sum to 100. When the male editor is displayed, the total for females will be shown in the next-to-the-last row and the total for both males and females will be shown in the last row. Before leaving this editor, be sure that the total is equal to 100 percent for all years; if it does not, you will see a warning such as “Males and females for 1995 total > 100.1! Return to editor?”

### 3. Impacts

To enter the impact assumptions for the AIDS projection,

1. Choose “Edit” from the menu bar.
2. Choose “AIDS (AIM)” from the pull-down menu.
3. Select “Impacts” from the “AIDS” dialogue box. This step will display an editor like the one shown below.




| | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|
| Exp per AIDS patient | 27200 | 27200 | 27200 | 27200 |
| Percent AIDS hospitalized | 40.00 | 40.90 | 41.80 | 42.70 |
| MOH budget (Millions) | 3170 | 3321 | 3472 | 3622 |
| Hospital beds | 30000 | 30000 | 30000 | 30000 |
| Bed capacity factor | 1.00 | 1.00 | 1.00 | 1.00 |
| Bed days/AIDS patient | 40.0 | 40.0 | 40.0 | 40.0 |
| Prop. 0-5 vac. for measles | 0.66 | 0.67 | 0.68 | 0.68 |
| Measles vaccine efficiency | 0.80 | 0.80 | 0.80 | 0.80 |
| Measles case fatality rate | 0.024 | 0.024 | 0.024 | 0.024 |
| Malaria episodes/person/year | 0.60 | 0.60 | 0.60 | 0.60 |
| Malaria case fatality rate | 0.0030 | 0.0030 | 0.0030 | 0.0030 |
| TB incidence without HIV (%) | 2.40 | 2.40 | 2.40 | 2.40 |
| Percent pop with latent TB | 50.00 | 50.00 | 50.00 | 50.00 |
| TB incidence with HIV (%) | 10.00 | 10.00 | 10.00 | 10.00 |

This screen contains a single section with all the assumptions displayed at once. For variable such as measles vaccine efficacy and the incidence of tuberculosis with and without HIV infections, default values are already filled in. Values for the other variables should be entered. Default values can be changed if better information is available. It is not necessary to enter information for all variables in order to make the projection. If no information is entered, then zeros will be displayed for the corresponding output indicators.

1. Click somewhere inside the editor to make the scroll bar appear.
2. Scroll to the right or left to see all the years and enter the data.

### 4. Leaving the Editors

Once you have entered all the necessary information,

1. Leave the editors by clicking on the “Ok” button. When you click the “Ok” button, the program will record your changes and return to the “AIDS” dialogue box.
2. Click on “Close” to keep your work, and you will return to the main program. If you decide that you do not want to keep the changes you have just made, click the “Cancel” button in any editor. This action will exit the AIDS editors and restore all inputs to their values before you entered the AIDS editors. Any changes you made during the current editing session will be lost.

### 5. Saving the Input Data

Once you have entered the projection assumptions, it is a good idea to save the data onto your hard disk. To do this, select “File” from the menu bar and “Save projection” from the pull-down menu. The data will be saved using the file name you specified earlier.

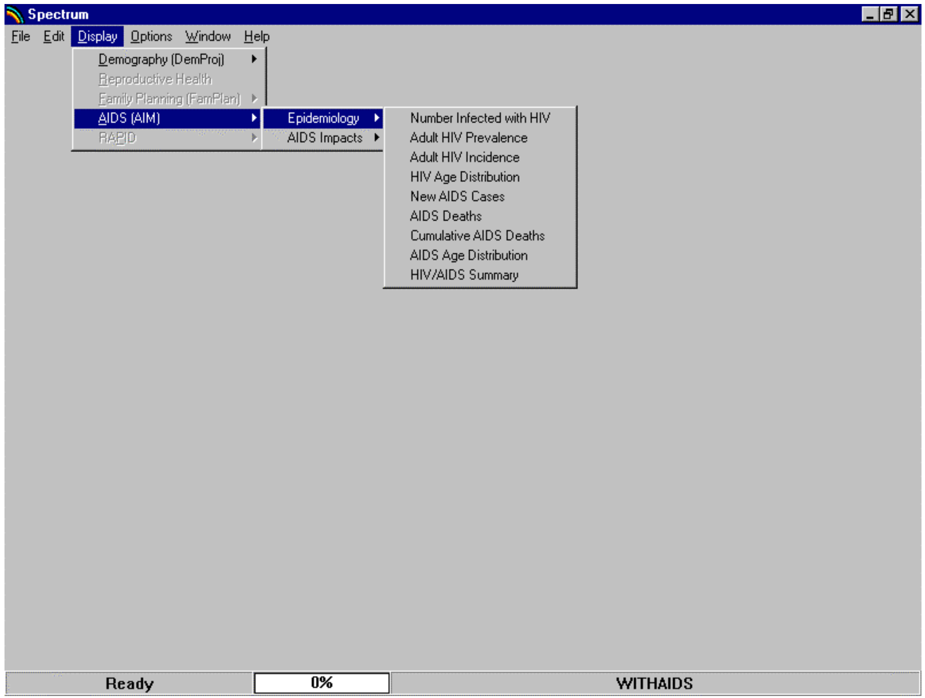
## E. Making the Projection

Whenever you enter data for a new projection or edit the assumptions, Spectrum will note that the data have been changed. The next time you try to display an indicator, it will inform you that the data may have changed and ask if you want to recalculate the projection. Normally, you should answer “Yes” to this question. Spectrum will then make the projection. This step may take only a few seconds or much longer, depending on the length of the projection and the number of modules being used. Once the projection is made, you will not be asked if you want to project the population again, unless you edit the assumptions.

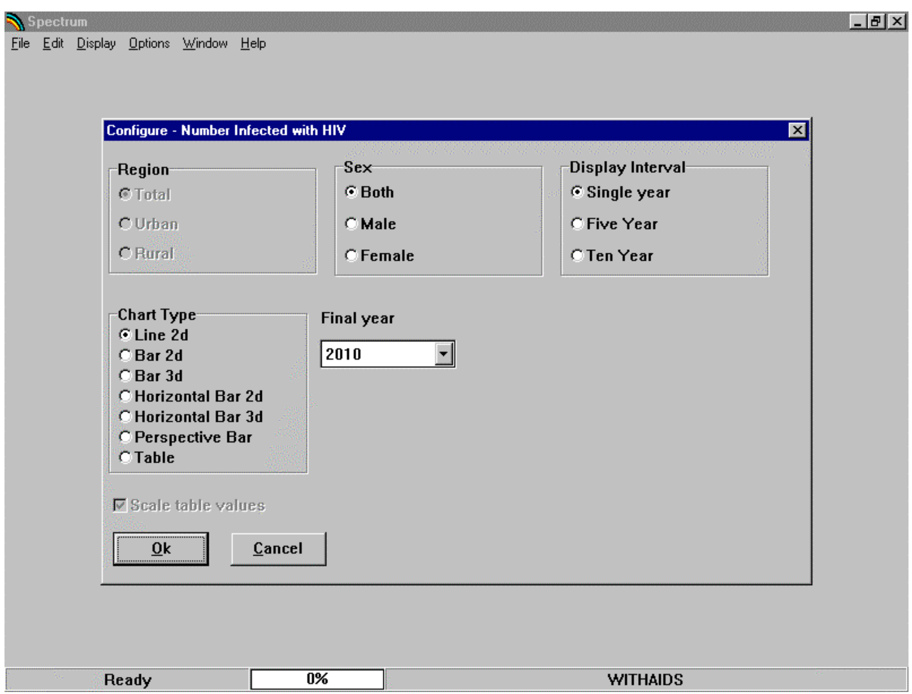
## F. Examining the Output

To see the results of the projection, select “Display” from the menu bar. From the pull-down menu select “AIDS.” You will then see another menu showing the two categories of indicators available:

- Epidemiology
- Impacts

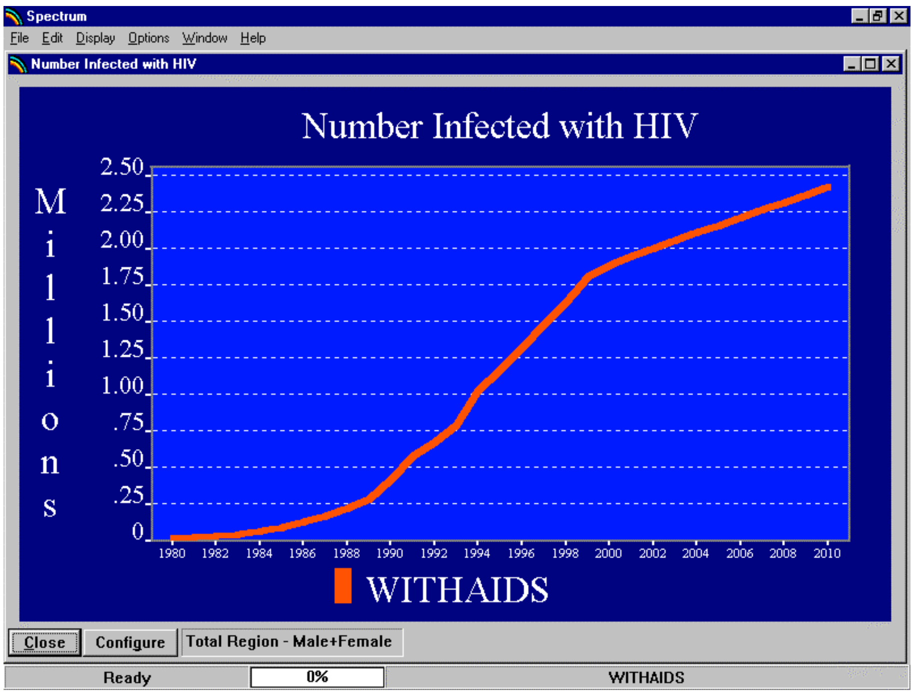



Choose one of these categories (the Epidemiology screen is shown above)and you will see one final menu listing the indicators available in that category. Select one of the indicators. Then you will see the display dialogue box. It will look something like the one shown below.



The exact choices available will depend on the indicator you have selected. For "Number infected with HIV," sex can be set to "Both," "Male," or "Female." The display will normally be in single years but you can change it to display every five or ten years if desired. The chart type is also set through this dialogue box. Click on the button next to the type of display you want. Normally the display will show all the years in the projection. However, if you want to see only part of the projection, you can change the final year by selecting a new final display year from the "Final year" list box.

Once you are satisfied with the type of display, click the "Ok" button and the display will appear. It will look something like the display shown below.




All the projections that are currently in use will be displayed on the same graph.

You can change the configuration of the display by clicking the "Configure" button. You can also change the type of display by putting the mouse pointer anywhere inside the chart and clicking with the right mouse button.

To close the display, click on the "Close" button. You do not have to close the display immediately. You can choose to display another indicator and it will appear on top of the first display. The first display will be covered but it will still be there. You can return to any previous display that you have not closed by choosing "Window" from the menu bar and selecting the name of the display from the pull-down menu. From the

“Window” selection you can also choose to tile or cascade all the existing display windows.

### 1. Graphs and Bar Charts

Spectrum will display a variety of graphs and bar charts, including:

- Line charts
- Two- and three-dimensional bar charts (column charts)
- Two- and three-dimensional horizontal bar charts
- Two- and three-dimensional overlap bar charts (bars for multiple projections are shown on top of each other)
- Three-dimensional perspective bar charts.

To print the active chart, select “File” from the menu bar and “Print” from the pull-down menu.

### 2. Tables

Spectrum will also display data in the form of tables. In tables, each projection that is in use will be displayed in a separate column. You can scroll through the table to see all the years by using the PgUp and PgDn keys or by using the mouse.

To print a table, select “File” from the menu bar and “Print” from the pull-down menu.

### 3. Displaying All Age Groups

If you wish to see the number of people with AIDS by age and sex, choose “Display,” “AIDS (AIM),” “Epidemiology,” and then “AIDS age distribution.”

You can display the information as a table, “Summary table,” or as a population pyramid showing either numbers of people (“Pyramid (numbers),” )or the percent distribution by age and sex (“Pyramid (percent)” ).

The pyramid display always shows two pyramids. If you are using a single projection, then the pyramids on both the left and the right will be for the base year. You can change the year for the pyramid on the right by clicking one of the buttons at the bottom of the screen to advance the pyramid one year (“Next”), show the previous year (“Previous”), show the first year (“First year”)or show the last year (“Last year”).

If you have two projections loaded, then the pyramid on the left will display the first projection and the one on the right will show the second projection. Both pyramids will display the same year.

If you have more than two projections loaded, you will be asked to choose which two pyramids should be shown before the pyramids appear.

#### 4. Summary Tables

The final choice in both the “Epidemiology” and “Impacts” menus is a summary table showing all the indicators and input assumptions. You can scroll through this page to see all the output. If you have more than one projection loaded, the indicators for the second projection will immediately follow the first. To print a table, select “File” from the menu bar and “Print” from the pull-down menu.

## G. Saving the Projection

It is always a good idea to save the projection whenever you make a change to any assumptions. To save the projection without changing the name, choose “File” from the menu bar and “Save projection” from the pull-down menu.

To save the projection with a different name, choose “File” from the menu bar and “Save projection as” from the pull-down menu. You will then have a chance to specify a new file name for the projection. Normally when you save the projection with a new name, you should also change the projection title. This step will avoid confusion if you have both projections loaded at the same time.

## H. Opening an Existing Projection

If you have already created an AIM projection or are using a projection provided by someone else, you can immediately load that projection.

1. Select “File” from the menu bar.
2. Select “Open projection” from the pull-down menu.
3. Select the file you wish to use and click the “Ok” button to open the projection.

You can open more than one projection at a time. Just repeat these steps to load a second or third projection. When you have more than one projection loaded, all projections will be displayed in the graphs and tables. The number of projections you can load at any one time is determined by the amount of available memory in your computer.

When you have more than one projection loaded, you will be asked to choose a projection when performing certain tasks, such as editing assumptions. The program will display a list of the projection names and you may choose the appropriate one from the list.

## I. Closing a Projection

To close a projection that has already been opened,

1. Choose “File” from the menu bar and
2. “Close projection” from the pull-down menu. If you have more than one projection loaded, you will be asked to select which projection should be closed.

Closing a projection just removes it from the computer’s memory; it does not erase it from the hard disk. You can open that projection again at any time.

# VI. Program Tutorial: Excel Version of AIM

A special spreadsheet version of the AIM module has also been created for use with the Spectrum system. This version is intended to allow counterparts to design and develop their own socioeconomic impact equations, using the demographic projections created through the Spectrum system. This version offers a great deal of flexibility to modify equations and add new ones. It does assume that the user is familiar with Microsoft Excel.

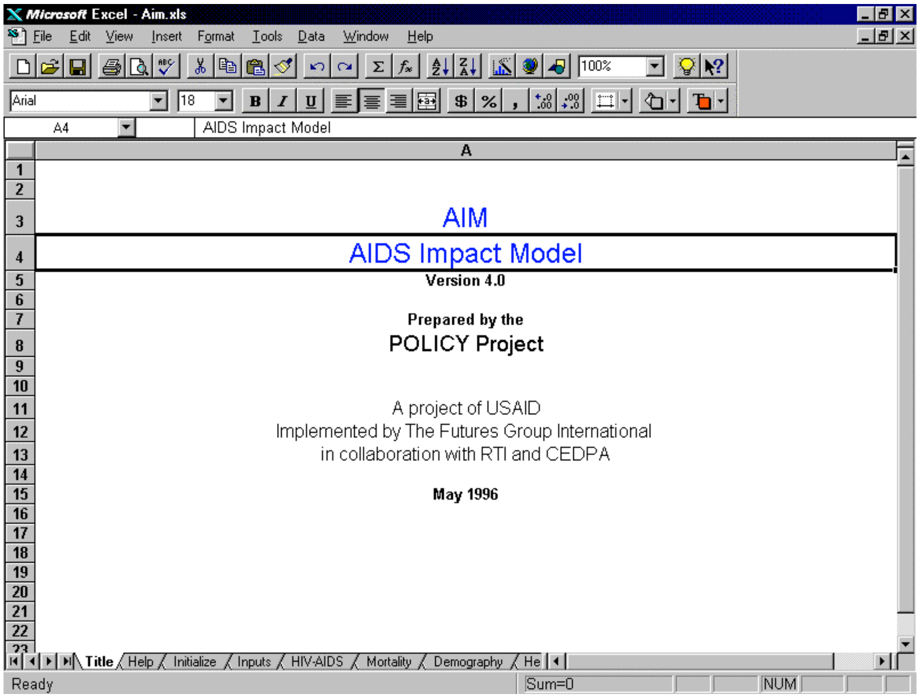
Population projections made with DemProj are used in the spreadsheet version of AIM. To save a DemProj file in a form suitable for use with the spreadsheet versions of AIM,

1. Select “File” from the menu bar.
2. Select “Export” from the pull-down menu.
3. Select “Demography” then “AIM.” After you specify the file name, the projection will then be saved in a special format that can be read into the spreadsheet versions of AIM.

## A. Loading the AIM Excel Spreadsheet

First start the Microsoft Excel program. Next, you need to open the AIM Excel spreadsheet. To do this,

1. Select “File” and “Open” from Excel.
2. Select the file titled “AIM.XLS” from your disk; if you installed Spectrum on your C drive, you will find the file in c:\spectrum\excel. The file will automatically load, and you will see the introduction screen.

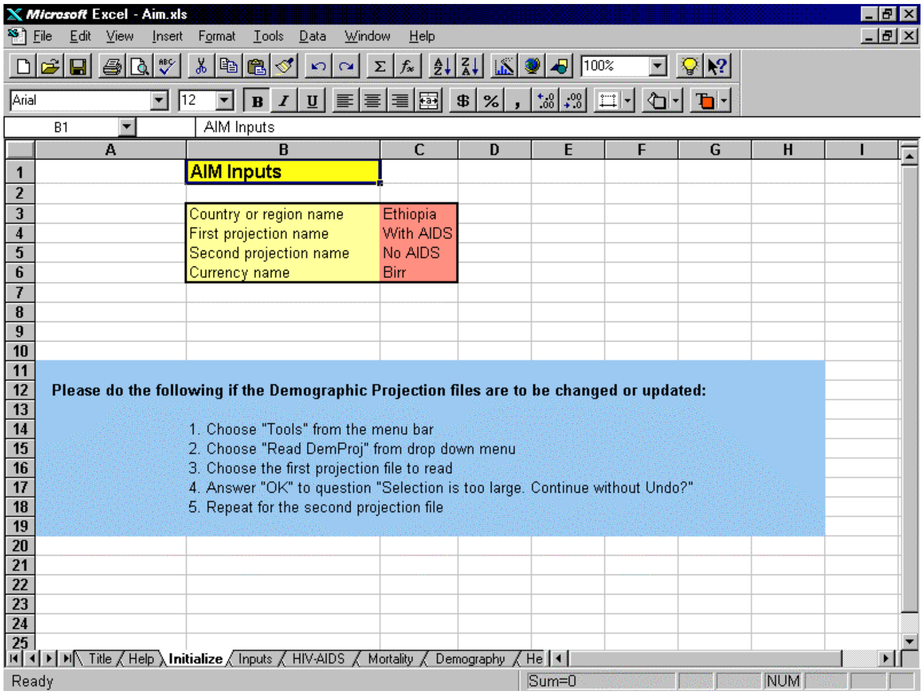



At the bottom of the screen are tabs allowing you to navigate through the spreadsheet (e.g., Title, Help, Initialize, Inputs, etc.). You can move through the spreadsheet by clicking on the appropriate tab.

## B. Initializing the Projection

Once the file has been loaded, it is necessary to enter certain basic information about the spreadsheet and read the appropriate demographic data files into the spreadsheet. This process is called “initialization” and must be done the first time data for a country are being analyzed. Once a file has been initialized and saved, it will only be necessary to initialize it again if the demographic data files change.

The initialization screen appears as follows.




At the top of the initialization screen, you can enter the name of the country or region, the label for the two projections that will be used (one constructed with AIDS data and one without), and the name of the currency. These values are entered in the red cells.

In the middle of the screen are instructions for loading demographic projection files into the file. To read the population projections into the spreadsheet, follow these steps:

1. Choose “Tools” from the Excel menu bar.
2. Choose “Read DemProj files” from the pull-down menu.
3. Select the first projection from the file dialogue box. Normally this will be the “With AIDS” projection; the file will usually be in c:\spectrum\data\ and will have an extension of .amx.
4. Answer “Ok” if the following question appears: “Selection is too large. Continue without undo?”
5. The second time the file dialogue box appears, select the second projection. Normally this will be the “No AIDS” projection.

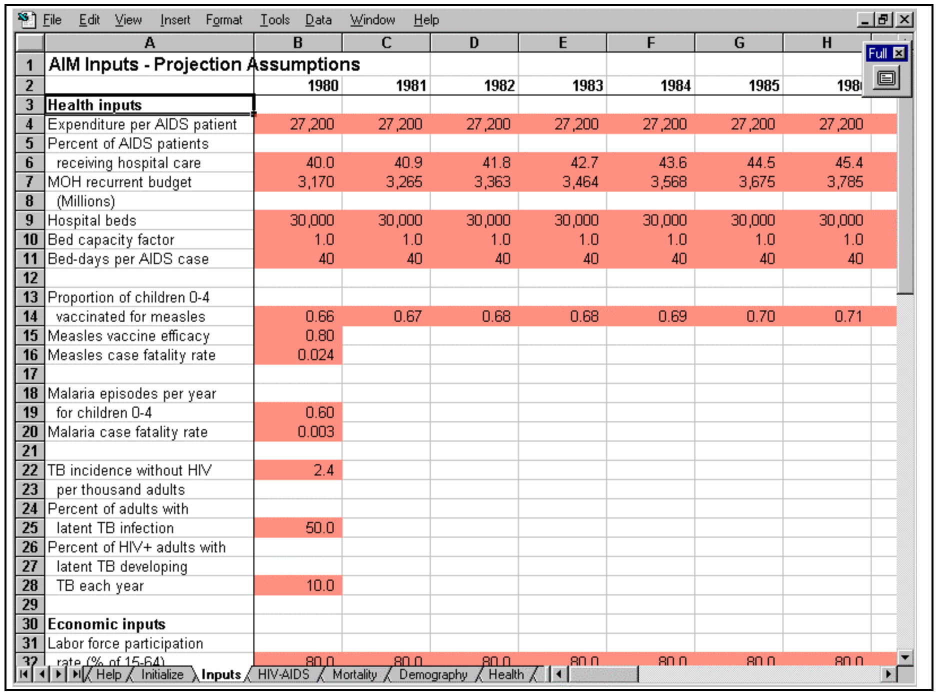
Once these steps are completed, the population projections from DemProj and the epidemiology projections from AIM will be read into the spreadsheet. It can then be used to examine the socioeconomic impacts.

This procedure described above may not work in all cases. It uses the Excel macro language and, therefore, may not work in all versions of Excel. If it does not work you can accomplish the same thing with the following steps:

1. Choose "File" and "Open" from the Excel menu bar.
2. At the bottom of the File Open dialog box, change the entry in the list box labeled "Files of type" to "All files (*.*)".
3. Locate the directory where you saved the data file that you "exported" from Spectrum to an AIM file. Once you are in the correct directory, you should see one or more files with the extension ".amx", for example, "withaids.amx".
4. Select the file that has the AIDS projection you want to use in AIM and click on the "Open" button.
5. You will now see a dialog box for the "File Import Wizard - Step 1 of 3". Click the "Next" button twice and then click the "Finish" button. This will cause Excel to read the data from the AIDS file into a new Excel spreadsheet.
6. Repeat steps 1-5 to read the second file that you exported from Spectrum, the projection with no AIDS.
7. From the "Window" command on the Excel menu, select the data file that has the AIDS projection in it, for example "withaids.amx".
8. Click on the small square above the label for row 1 and to the left of the label for column A. This will select the entire spreadsheet.
9. Now select "Edit" and "Copy" from the Excel menu to copy the contents of the spreadsheet to the Windows clipboard.
10. Return to the AIM spreadsheet by selecting "Windows" from the Excel menu and aim.xls from the pull-down menu.
11. Select the worksheet called "DemProj-A" and place the cursor in cell A1, the cell in the upper left-hand corner.
12. Select "Edit" and "Paste" from the Excel menu. This will paste the data from the Spectrum projection file into this worksheet.
13. Repeat steps 7-12 for the projection file with no AIDS, for example "noaids.amx". After copying the data to the clipboard (step 9) move to the worksheet called "DemProj-B" and paste the data into this spreadsheet (steps 11 and 12).
14. You have now successfully copied the Spectrum projections into the Excel spreadsheet and can proceed with the rest of this tutorial.

## C. Entering Assumptions

The Excel version of AIM requires the same input assumptions to calculate impact as the Spectrum version, but additional inputs are required to project the economic impacts. These are entered in the worksheet labeled "Input." When you select the "Inputs" tab, you will see a display like the one shown below.



| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | AIM Inputs - Projection Assumptions | | | | | | | |
| 2 | | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 198 |
| 3 | **Health inputs** | | | | | | | |
| 4 | Expenditure per AIDS patient | 27,200 | 27,200 | 27,200 | 27,200 | 27,200 | 27,200 | 27,200 |
| 5 | Percent of AIDS patients | | | | | | | |
| 6 | receiving hospital care | 40.0 | 40.9 | 41.8 | 42.7 | 43.6 | 44.5 | 45.4 |
| 7 | MOH recurrent budget | 3,170 | 3,265 | 3,363 | 3,464 | 3,568 | 3,675 | 3,785 |
| 8 | (Millions) | | | | | | | |
| 9 | Hospital beds | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| 10 | Bed capacity factor | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 11 | Bed-days per AIDS case | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| 12 | | | | | | | | |
| 13 | Proportion of children 0-4 | | | | | | | |
| 14 | vaccinated for measles | 0.66 | 0.67 | 0.68 | 0.68 | 0.69 | 0.70 | 0.71 |
| 15 | Measles vaccine efficacy | 0.80 | | | | | | |
| 16 | Measles case fatality rate | 0.024 | | | | | | |
| 17 | | | | | | | | |
| 18 | Malaria episodes per year | | | | | | | |
| 19 | for children 0-4 | 0.60 | | | | | | |
| 20 | Malaria case fatality rate | 0.003 | | | | | | |
| 21 | | | | | | | | |
| 22 | TB incidence without HIV | 2.4 | | | | | | |
| 23 | per thousand adults | | | | | | | |
| 24 | Percent of adults with | | | | | | | |
| 25 | latent TB infection | 50.0 | | | | | | |
| 26 | Percent of HIV+ adults with | | | | | | | |
| 27 | latent TB developing | | | | | | | |
| 28 | TB each year | 10.0 | | | | | | |
| 29 | | | | | | | | |
| 30 | **Economic inputs** | | | | | | | |
| 31 | Labor force participation | | | | | | | |
| 32 | rate (% of 15-64) | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 |

Values for each of the variables are entered into the orange cells. In most cases, you can enter a value for the first and last years and the spreadsheet will automatically interpolate between them. Of course, you can replace any of these interpolated cells with your own values if you wish.

## D. Viewing Results

Once the DemProj files have been read into the spreadsheet and the assumptions have been entered, you can view the results. The projections are located in worksheets labeled:

- HIV/AIDS
- Mortality
- Demography
- Health
- Economy
- Orphans

The worksheet "Charts" displays most of the indicators in chart format.

In each display worksheet, you can see the calculations for each projection (e.g., With AIDS and No AIDS). Immediately below the results in blue are documented the equations used to calculate these results. In order to change an equation you need to edit the formula in the cell that displays the results. You can insert additional indicators into the spreadsheet by following the format shown for the existing indicators.

## E. Saving

Be sure to save your new AIM spreadsheet. In order to preserve the original, general version of the AIM spreadsheet, it is a good idea to save your new spreadsheet with a different name. To do this, choose "File" from the Excel menu, then choose "Save" from the pull-down menu.

# VII. Preparing AIM Presentations

One of the main uses of the AIM module is to prepare the projections required for an AIM presentation. The presentation itself is usually prepared using software such as PowerPoint. The presentation may be in the form of a computer slide show, color slides, color transparencies, or some other appropriate medium.

AIM presentations for different countries, regions and topics will be different. The content will depend on the goal of the presentation activity, the data available, and the level of knowledge and interests of the intended audience.

Although each AIM presentation is unique, there is a core set of points that will be included in most presentations. Some of the information required for these points is derived from the AIM projections, some is based on current country-specific data (such as the number of reported AIDS cases) and some is drawn from the general literature on AIDS. A template AIM presentation in PowerPoint is available from the POLICY Project and is included with the Spectrum installation. Users are encouraged to use this sample only as a starting point and to modify it as necessary for their applications.

One good source of ideas for AIM presentations is presentations that have been prepared by other countries and programs. Copies of AIM presentations and AIM booklets can be obtained from the AIDS control programs in Kenya, Ethiopia, Ghana, Madagascar and Zimbabwe.

An example of a typical AIM presentation—which roughly follows the template—is included as Appendix A to this manual. The appendix also contains a number of charts that have been used in several AIM applications and a description of the main points addressed by each chart.

For more information on customizing AIM presentations to your purposes and audiences, please contact the POLICY Project at the address shown in Chapter 1.

# VIII. Methodology

## A. Epidemiology

The AIDS projections in AIM are based on an approach suggested by James Chin and Jonathan Mann of the Global Programme on AIDS, WHO (Chin and Lwanga, 1989) and adapted for spreadsheet calculations by David Sokal of Family Health International and John Stover of The Futures Group International. The approach is based on the fact that a certain proportion of those infected with HIV at time *t* are assumed to develop AIDS by time *t+n.* Thus, if we know the number of people infected by year and we know the proportion progressing to AIDS by time since infection, we can determine the number of new AIDS cases each year. This approach is used in both the EpiModel and AIDSproj programs discussed in Chapter III, Section B. This methodology has been adapted for AIM via development of an age-specific version and incorporation of a more exact calculation of AIDS deaths and non-AIDS deaths. The complete methodology is described below.

### 1. Adult Population

The number of adults is the sum of the population aged 15 and over.

$$adults_t = \sum_{a,s} Pop_{a,s,t,}$$

where

a = 15 to 80+

s = males, females

## 2. HIV-infected Adults

The number of adults infected with HIV is the sum of the infected population for each age from 15 to 80+.

$$HIV\_adults_t = \sum_{a,s} HIV\_Pop_{a,s,t}$$

where

a = 15 to 80+

s = males, females

## 3. Target Number of HIV-Prevalent Cases

The number of HIV-infected adults at time *t* that matches the assumed prevalence level is the number of adults multiplied by the assumed prevalence:

$$Target\_HIV_t = adults_t \bullet prevalence_t.$$

## 4. New Adult HIV Infections

The number of new adult HIV infections in any year is calculated as the target number minus the number of adults already infected:

$$New\_adult\_HIV_t = Target\_HIV_t - HIV\_adults_t.$$

If some new infections (that are not acquired perinatally) are assumed to occur to children under the age of 15, then given the assumed level of adult prevalence, the number of new infections among adults needs to be increased by the proportion of new infections that will occur to children:

$$New\_adult\_HIV_t = ( Target\_HIV_t - HIV\_adults_t ) / Percent\_New\_HIV\_Under15.$$

## 5. New HIV Infections by Age and Sex

The new HIV infections are distributed by age and sex according to the distribution entered as an input assumption:

$$New\_HIV_{a,s,t} = New\_adult\_HIV_t \bullet Percent\_new\_infections_{a,s,t}.$$

## 6. Surviving HIV Infections

Some number of persons with new infections at time *t* who survive into future years will be subject to death due to AIDS and death due to non-AIDS causes. The number surviving is first adjusted by non-AIDS deaths:

$$HIV\_infection_{a,s,t,y} = HIV\_infection_{a-1,s,t-1,t} \bullet (1 - mortality\_rate_{a,s,t}),$$

where

$HIV\_infection_{a,s,t,y}$ = the number of persons who survive HIV infections in age group *a*, of sex *s*, at time *t*, who were initially infected in year *y*.

Survivors of HIV infections are further reduced by the number of people who die due to AIDS:

$$HIV\_infection_{a,s,t,y} = HIV\_infection_{a,s,t,y} - AIDS\_deaths_{a,s,t,y}.$$

The total number surviving with HIV in any year is the sum of those surviving to that year from cohorts of infection from all previous years:

$$HIV\_infection_{a,s,t} = \sum_{y} HIV\_infection_{a,s,t,y}$$

## 7. New AIDS Cases

The number of new AIDS cases in time *t* is calculated as the sum of the number of people progressing to AIDS in time *t* who were infected in the 20 years before time *t*.

$$New\_AIDS_{a,s,t} = \sum_{y} NewHIV_{a,s,y} \bullet Prop\_progressing\_to\_AIDS_{t-y},$$

where *y* varies from *t*-20 to *t*.

## 8. AIDS Deaths

AIDS deaths are simply the number of new AIDS cases lagged by the life expectancy after AIDS:

$$AIDS\_deaths_{a,s,t} = New\_AIDS_{a,s,t-ALE}$$

If the AIDS life expectancy (ALE) is not entered as an integer number of years, then the deaths are distributed between the two years proportionally. For example, if the life expectancy after AIDS were assumed to be 1.5 years, then half of the new AIDS cases would be assumed to die one year later and half two years later.

## 9. Perinatal Infections

The number of infected children is determined by the number of infected babies born. The number of infected babies is a function of the perinatal transmission rate (PTR), fertility, and the percentage of mothers who are infected:

$$HIV\_births_t = PTR \bullet TFR_t \bullet \sum_a ASFP_{a,t} \bullet HIV\_infection_{a,f,t} ,$$

where

| | | |
|---|---|---|
| $HIV\_births_t$ | = | the number of infected births at time *t* |
| PTR | = | perinatal transmission rate |
| $TFR_t$ | = | total fertility rate at time *t* |
| $ASFP_{a,t}$ | = | the age-specific fertility proportion, or the proportion of lifetime births that occur during age *a* and at time *t* |
| $HIV\_infection_{a,f,t}$ | = | the number of infected females at age *a* and time *t* |

Children progress from HIV to AIDS to death in a manner similar to adults; however, the time to progress from HIV to AIDS is much shorter for children.

## 10. AIDS Orphans

The definition of an AIDS orphan used in AIM is a child under the age of 15 who has lost its mother to AIDS.

First we calculate the number of children under the age 15 whose mothers are still alive:

$$CEB15_t = \sum_{1=t-14}^{t} \sum_{a1=15}^{49} TFR_{t1} \bullet ASFP_{a1} \bullet POP_{a1,f,t1}$$

where

| | | |
|---|---|---|
| $CEB15_t$ | = | number of women under age 15 whose mothers were living at time *t* |
| $POP_{a1,f,t1}$ | = | women currently living who were age *a1* at time *t* |
| $TFR_{t1}$ | = | total fertility rate at time *t* |
| $ASFP_{a1}$ | = | percentage of lifetime births which occurred to age group *a1* |

In this equation, births are summed across the reproductive ages of currently living women, for each of the 15 preceding years.

Next we calculate the number of children under the age of 15 who have not died from AIDS and who were ever born to females who died from AIDS:

$$ACEB15_{a,t} = \sum_{a1-15}^{64} TFR_{t-a} \bullet ASFP_{a1-a,t-a} \bullet FAD_{a1,t} \bullet [1 - PTR \bullet PropHIV_a],$$

where

| | | |
|---|---|---|
| $ACEB15_{a,t}$ | = | The number of children under the age of 15 of age *a* who have not died from AIDS who were ever born to females who died from AIDS at time *t* |
| $TFR_{t-a}$ | = | TFR *a* years earlier |
| $FAD_{a1,t}$ | = | The number of female AIDS deaths occurring at age *a1* at time *t* |
| $PropHIV_a$ | = | The proportion of women who would be HIV positive *a* years before death. |

This equation is similar to the first one for CEB except that it counts only children born to women who died of AIDS at time *t* rather than children born to all women. This figure is further adjusted to remove those children who have died from AIDS. The expression *1-PTR* is the proportion of infants who are not infected if the mother is infected. The variable P*ropHIV* accounts for the fact that the women may not have been infected during the entire 15 years. $PropHIV_a$ is the proportion of women who died from AIDS at *t* who were HIV-positive *t-a* years earlier. This proportion is essentially the same as the cumulative proportion of people who develop AIDS by time since infection, but shifted by one year to account for the lag from AIDS to death.

The first two equations described above determine the number of children ever born. They need to be adjusted to account for the fact that some of these children will have died before year *t* from causes other than AIDS. This step is accomplished by dividing the number of children alive today by the number of children ever born. This adjustment factor accounts for non-AIDS mortality. Therefore, the number of new orphans, created in year *t* by female deaths in that year, becomes:

$$New\_AIDS\_orphans_{a,t} = ACEB15_{a,t} \bullet \frac{Pop_{a,t}}{CEB15_{a,t}}.$$

The total number of AIDS orphans in any year is increased by newly created orphans and decreased by child deaths and by children becoming older than 15. For any particular age *a*, the number of orphans at time *t* will equal the number of new orphans created in that year plus the number of orphans aged *a-1* at time *t-1* who survive to year *t*. Thus, the equation for the total number of orphans at age *a* is:

$$AIDS\_orphans_{a,t} = New\_AIDS\_orphans_{a,t} + AIDS\_orphans_{a-1,t-1} \bullet SR_{a-1,t-1}$$

where:

$SR_{a,t}$ = The survival ratio from age *a-1 t-1* to age *a t*.

The survival ratio in this equation is the survival ratio for all children calculated from the non-AIDS life expectancy and a model life table. This figure may underestimate orphan mortality if children who have lost their mother do not receive the same quality of care as children who remain with their natural mothers.

## B. Health

### 1. AIDS Treatment Costs

To calculate the total AIDS treatment costs, first the model multiplies the lifetime cost of treating AIDS patients by the number of AIDS patients who seek care from the public health system. This figure is then divided by the average post-AIDS life expectancy.

$$ATC_t = \frac{AIDS_t \bullet \frac{PercHosp_t}{100} \bullet LifetimeCost}{ALE},$$

where:

| | | |
|---|---|---|
| $ATC_t$ | = | AIDS treatment costs |
| $AIDS_t$ | = | Number of people at time *t*, who have AIDS |
| $PercHosp_t$ | = | Percentage of AIDS patients seeking care from the public health system at time *t* |
| LifetimeCost | = | Lifetime cost of treating an AIDS patient |
| ALE | = | Average life expectancy after developing AIDS. |

## 2. Percent of Ministry of Health Expenditures on AIDS

Ministry of Health expenditures overall — independent of HIV/AIDS treatment and intervention — are a direct input to AIM supplied by the user.

The percentage of Ministry of Health expenditures required care for AIDS patients is calculated as the AIDS treatment costs divided by total Ministry of Health expenditures:

$$MOHexp\%_t = \frac{ATC_t}{MOHexp_t},$$

where:

| | | |
|---|---|---|
| $MOHexp_t$ | = | Total expenditures by the Ministry of Health at time *t (t=0* in the base year). |

## 3. Number of Hospital Beds Required for AIDS Patients

The number of hospital beds required is calculated by multiplying the number of AIDS patients using the public health system by the average number of days hospitalized.

$$AIDSbeds_t = (AIDS \bullet \frac{PercHosp}{100}) \bullet Bed\text{-}Days,$$

where

| | | |
|---|---|---|
| AIDSbeds | = | The number of hospital bed-days required for AIDS patients |
| BedDays | = | The average number of days occupying a bed (bed-days) per year per hospitalized AIDS patient. |

### 4. Total Number of Hospital Bed-days

The total number of hospital bed-days available is a function of the number of beds and the rate at which they are used.

$$HospBedDys = Beds \bullet CapacityFactor \bullet 365,$$

where

| | | |
|---|---|---|
| Beds | = | Number of hospital beds available |
| CapacityFactor | = | The average capacity utilization of hospital beds. |

For comparison with AIDS, AIM can calculate annual occurrence of several diseases in the child (age 0-4) and adult populations.

### 5. Child Malaria Cases

$$MalariaCases_t = Pop_{0-4,t} \bullet MalariaCaseRate_t,$$

where

| | | |
|---|---|---|
| $MalariaCases_t$ | = | The annual number of child cases of malaria at time *t* |
| $Pop_{0-4,t}$ | = | The population of children aged four and under at time *t* |
| $MalariaCaseRate_t$ | = | The average number of episodes of fever per child per year at time *t*. |

## 6. Child Measles Cases

The number of child cases of measles per year is calculated by first determining the number of children susceptible to measles. This is the number of children between the ages of zero and four multiplied by the proportion who are susceptible (usually 100 percent). Some children are not vaccinated. In this case, all susceptible children will develop measles; thus, the expression *1-PropVac* determines the proportion of children who will develop measles because they are not vaccinated. Most children who are vaccinated will not develop measles, but the vaccine is not 100 percent effective. Thus, the expression *PropVac • (1-Eff)* determines the proportion of children who will get measles even though they received the vaccination. Since children contract measles only once in their lifetime, the entire equation is multiplied by 1/5, to calculate the annual rate of measles among all children aged 0-4 (a child could develop measles in any of the five years from age zero to four, but in only on of those years).

$$Measles_{t} = Pop_{0\text{-}1,t} \cdot PropSus \cdot [1-PropVac) + PropVac \cdot (1-Eff)] \cdot 1/5,$$

where:

| | | |
|---|---|---|
| $Measles_t$ | = | The number of child measles cases per year at time *t* |
| PropSus | = | The proportion of children susceptible to measles |
| PropVac | = | The proportion of children vaccinated against measles |
| Eff | = | The proportion of vaccinated children who are protected from measles infection |

## 7. Child Malaria Deaths

$$MalariaDeaths_t = MalariaCases_t \cdot MalariaCFR_t\ ,$$

where

| | | |
|---|---|---|
| $MalariaDeaths_t$ | = | The annual number of child deaths from malaria at time *t* |
| MalariaCFR | = | The case fatality rate for malaria |

### 8. Child Measles Deaths

$$MeaslesDeaths_t = Measles_t \bullet MeaslesCFR,$$

where

| | | |
|---|---|---|
| $MeaslesDeaths_t$ | = | The annual number of child deaths from measles at time *t* |
| MeaslesCFR | = | The case fatality rate for measles |

### 9. Number of Cases of Non-HIV Tuberculosis

$$Non\_HIV\ TB_t = Tbincidence \bullet \sum_{a=15}^{80+} Pop_{at}$$

where

| | | |
|---|---|---|
| Non-HIV $TB_t$ | = | The annual number of cases of tuberculosis (TB)that are not related to HIV infection, at time *t* |
| TBincidence | = | The normal incidence of TB cases in the adult population. |

### 10. Number of Cases of HIV-Related Tuberculosis

$$HIV\_TB_1 = PercTB \bullet HIV\_Tbincidence \bullet \sum_{a=15}^{80+} HIV\_Pop_{a,s,t}$$

where

| | | |
|---|---|---|
| $HIV\_TB_t$ | = | The annual number of TB cases that are related to HIV infection, at time *t* |
| PercTB | = | The percentage of the adult population with latent TB infection |

HIV_TBincidence = The proportion of HIV-positive individuals developing TB each year.

## C. Economy

Several of the economic factors in AIM are strongly related to aspects of the labor force.

### 1. Labor Force

$$LF_{st} = \sum_{a=15}^{69} Pop_{a,s,t} \bullet LFPR_{a,s,t}$$

where

$LF_{s,t}$ = Size of the labor force by sex at time *t*

$LFPR_{a,s,t}$ = Labor force participation rate by age and sex at time *t*

### 2. Experience Level of the Labor Force

The average experience level of the labor force is calculated as the average age of workers minus the average age at entrance to the labor force.

$$AvgLFexp_{s,t} = AvgLFage_{s,t} - AvgStartAge_{s,t}$$

$$AvgLFexp_{s,t} = \frac{\sum_{a=15}^{69} a \bullet pop_{a,s,t} \bullet LFPR_{a,s,t}}{\sum_{a=15}^{69} Pop_{a,s,t} \bullet LFPR_{a,s,t}}$$

$$AvgStartAge_{s,t} = \frac{\sum_{a=15}^{69} a \bullet Pop_{a,s,t} \bullet (LFPR_{a,s,t} - LFPR_{a-1,s,t})}{\sum_{a=15}^{69} Pop_{a,s,t} \bullet (LFPR_{a,s,t} - LFPR_{a-1,s,t})},$$

where

| | | |
|---|---|---|
| $AvgLFexp_{s,t}$ | = | The average number of years of experience in the labor force for those currently in the labor force, for males and females, at time *t* |
| $AvgStartAge_{s,t}$ | = | The average age of entry into the labor force by sex and at time *t* |

*AvgStartAge* is only calculated for those ages where $LFPR_{a,s,r,t}$ is greater than $LFPR_{a-1,s,t}$; in other words, only for those ages where there are still net labor force entrants.

### 3. Number of Productive Years of Life

The number of productive years of life for an individual is defined to be the number of years between the ages of 15 and 64 that the individual spends in the labor force. This figure would be 49 for all individuals if everyone survived to age 65 and everyone was in the labor force for the entire time. Since few people are in the labor force this entire period, and since people will die before reaching age 65, the average number of productive years of life for an entire population is much less than 49. AIDS increases the death rate to the population under the age of 65 and, therefore, reduces the average number of productive years of life.

$$ProdYears_{s,t} = \sum_{a=0}^{64} Surv_{a,s,t} \bullet LFPR_{a,s,t}$$

where

| | | |
|---|---|---|
| ProdYears | = | The average number of productive years of life for an individual |
| $Sr_a$ | = | The proportion of people who survive from birth to age *a* |

### 4. Gross Domestic Product

The size of the gross domestic product, with and without AIDS, can be projected in the Excel version of AIM. GDP is calculated with a Cobb-Douglas production function that expresses the size of GDP as a function of the size of the labor force, the amount of capital stock, and the rate of technical progress.

$$GDP_t = Constant \bullet (1 + RTP)^t \bullet Capital_t^a \bullet LF_t^b$$

where

| | | |
|---|---|---|
| GDP | = | gross domestic product |
| Constant | = | a constant multiplier |
| RTP | = | annual rate of technical progress |
| Capital | = | the value of the capital stock |
| a | = | elasticity of output to capital |
| LF | = | the size of the labor force |
| b | = | elasticity of output to labor. |

The constant multiplier is calculated from the GDP equation to provide the correct GDP value in the base year.

$$Constant = GDP_1 / ( Capital_1^a \bullet LF_1^b ) .$$

The size of the capital stock is calculated as the amount of capital in the previous year plus gross domestic investment (GDI) minus depreciation:

$$Capital_t = Capital_{t-1} + GDI_t - depreciation_t .$$

Depreciation is the value of the capital stock divided by the average lifetime of capital:

$$Depreciation_t = Capital_{t-1} / Average\ lifetime\ of\ capital.$$

Gross domestic investment is calculated as the GDP multiplied by the percent of GDP that is invested each year minus the amount of savings that is diverted from investment to expenditures for AIDS care.

$$GDI_t = GDP_{t-1} \bullet \%GDI - AIDS_t \bullet ExpenditurePerAIDS \bullet PercentFromSavings,$$

where

| | | |
|---|---|---|
| %GDI | = | the percent of GDP that is gross domestic investment |
| AIDS | = | the number of new AIDS cases |
| ExpenditurePerAIDS | = | the health care expenditure per AIDS patient |
| PercentFromSavings | = | the percentage of AIDS care financed from savings. |

### 5. Gross Domestic Product Per Capita

Gross domestic product per capita is calculated as the GDP divided by the size of the population:

$$GDP/cap_t = GDP_t \ / \ population_t \ .$$

# IX. References

*Note: Abstracts from the various International Conferences on AIDS are available from the World Wide Web site for the AIDS Education Global Information System (AEGIS), http://www.aegis.com. The site is searchable by key words or phrases. Full papers can be obtained as noted on each abstract.*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# X. Glossary of Terms

Most of the definitions were obtained from the United Nations World Wide Web site:

http://www.us.unaids.org/highband/humanint/glossary.htm.

**Adult.** In AIM, an adult is defined as a person aged 15 or older.

**AIDS.** The abbreviation for the acquired immune deficiency syndrome, a disabling and fatal disease caused by the human immunodeficiency virus (HIV).

**Epidemiology.** The study of the incidence, distribution, and determinants of an infection, disease, or other health-related event in a population. Epidemiology can be thought of in terms of who, where, when, what, and why. That is, who has the infection/disease, where are they located geographically and in relation to each other, when is the infection/disease occurring, what is the cause, and why did it occur?

**HIV.** The human immunodeficiency virus is the virus that causes AIDS. Two types of HIV are currently known: HIV-1 and HIV-2. Worldwide, the predominant virus is HIV-1. Both types of virus are transmitted by sexual contact, through blood, and from mother to child, and they appear to cause clinically indistinguishable AIDS. However, HIV-2 is less easily transmitted, and the period between initial infection and illness is longer in the case of HIV-2.

**HIV Infection.** Infection with the human immunodeficiency virus (HIV). HIV infection is primarily a sexually transmitted infection, passed on through unprotected penetrative sex. The virus can also be transmitted through blood transfusions, through the use of unsterilized injection equipment or cutting instruments, and from an infected woman to her fetus or nursing infant.

**HIV Sentinel Surveillance.** The systematic collection and testing of blood from selected populations at specific sites—for example, pregnant women attending prenatal clinics—for the purpose of identifying trends in HIV prevalence over time and place.

**Incubation Period.** The time interval between infection and the onset of AIDS.

**Interpolation.** Given two numbers that serve as boundary points, it is possible to estimate the values that lie at intervals between the two points. For example, if the HIV prevalence rate for a country or region was actually measured only in 1985 and in 1995, by assuming even increments from year to year, it is possible to interpolate a TFR for each intervening year. Spectrum uses a linear form of interpolation so that the difference between each annual value is the same. Other nonlinear forms of interpolation are also possible but are not used in Spectrum.

**Life Expectancy.** The average number of years a newborn can expect to live, based on the mortality and conditions of the time.

**Orphan.** In this manual, an orphan is defined as a child under the age of 15 whose mother has died of AIDS. It is assumed that if the mother has AIDS, the father will have the fatal disease as well.

**Perinatal and Perinatal Transmission.** Pertaining to or occurring during the periods before, during, or shortly after the time of birth; that is, before delivery from the 28th week of gestation through to the first seven days after delivery. The transmission of HIV from an infected woman to her fetus or newborn child is referred to as perinatal transmission.

**Prevalence.** The proportion of a defined population with the infection, disease, or other health-related event of interest at a given point or period of time.

**Seroprevalence (HIV, STD).** The percentage of a population from whom blood has been collected that is found, on the basis of serology, to be positive for HIV or other STD agents at any given time.

**Sentinel Surveillance.** See HIV Sentinel Surveillance.

# XI. Acronyms and Abbreviations

| | |
|---|---|
| **AIDS** | acquired immune deficiency syndrome |
| **AIDSCAP** | AIDS Control and Prevention Project (USAID-funded) |
| **AIDSTECH** | AIDS Technical Support Project (USAID-funded) |
| **AIM** | AIDS Impact Model |
| **CDC** | Centers for Disease Control and Prevention |
| **FHI** | Family Health International |
| **GDP** | gross domestic product |
| **GNP** | gross national product |
| **HIV** | human immunodeficiency virus |
| **ILO** | International Labor Organization |
| **MOH** | Ministry of Health |
| **NACP** | national AIDS control program |
| **PTR** | perinatal transmission rate |
| **STD** | sexually transmitted disease |
| **TFR** | total fertility rate |
| **TB** | tuberculosis |
| **UNAIDS** | Joint United Nations Programme on HIV/AIDS |
| **USAID** | United States Agency for International Development |

# Appendix A.

# Key Charts in a Typical AIM Presentation

# AIDS in CountryName

Background
Projections
Impact
Interventions

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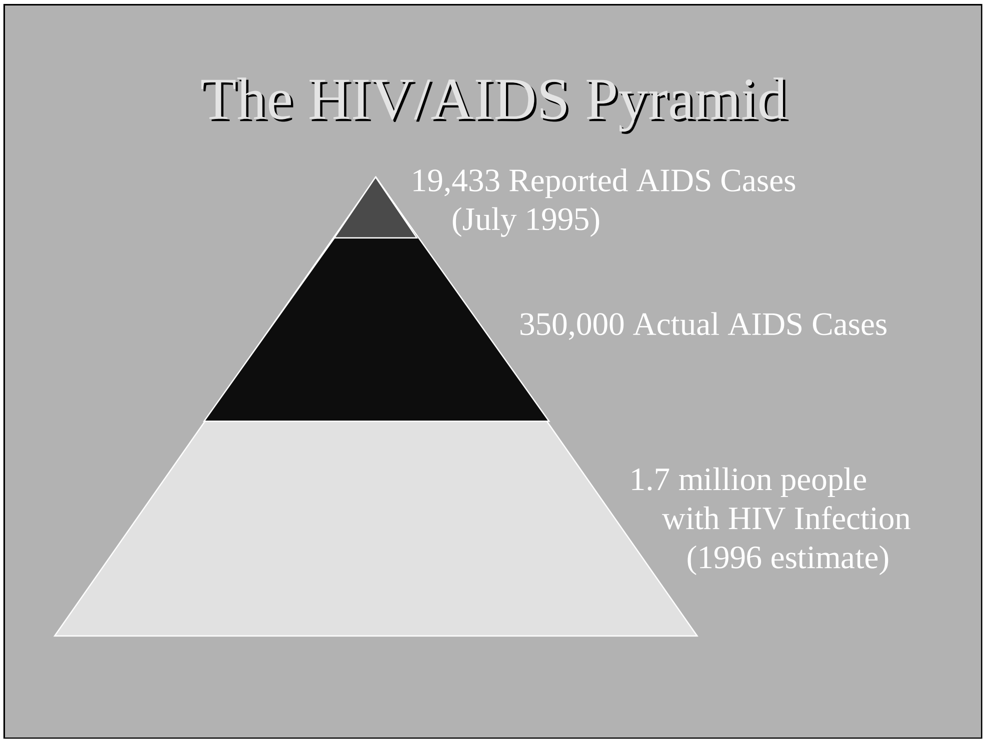
*Prepared by*
National AIDS Control Programme
Ministry of Health

# Presentation Outline

- Background
- Projections
- Impacts
- Interventions
- Needs




There have been xx cases of AIDS reported to the Ministry of Health since the beginning of the AIDS epidemic. These reported AIDS cases represent the visible part of the epidemic. This is what most people see. However, there is much more to the epidemic than the number of reported cases.

We know that not all AIDS cases are reported. This can happen for several reasons:

•some people never seek hospital care for AIDS,

•some doctors may not want to record a diagnosis of AIDS because of the stigma attached to AIDS,

•some people with HIV infection may die of other diseases before they are ever diagnosed as having AIDS, and

•some rural heath care facilities may not have the capability to test for HIV infection.

The true number of AIDS cases is not known. However, it is estimated that at least xxx adults and children have developed AIDS.

AIDS cases are only the tip of the pyramid. Many more people are infected with HIV, the virus that causes AIDS. It is estimated that in 1995 there were about xx people infected with HIV. This includes about xx adults and xx children. Most of these people do not know they are infected. They may have no symptoms at all. However, almost all will develop AIDS and die within the next 10 years or so. There is no cure for AIDS.

## Adult HIV Prevalence

1984 → 1989 → 1993 → 1996

0.0% → 1.0% → 3.2% → 5.2%

1993: Urban = 12%, Rural = 1.5%

1996: (Estimated)

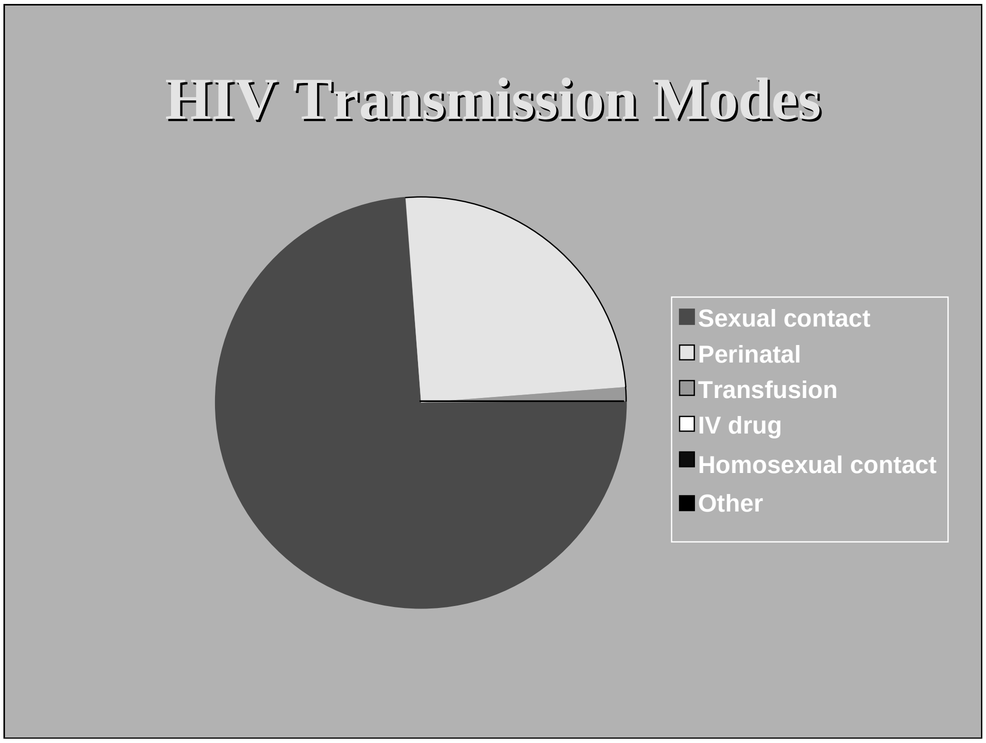
Number infected with HIV in 1996 : 1.6 million adults

120,000 children

HIV probably started to spread in XXX in the early 1980s. The first evidence of HIV infection was found in 1984. The first AIDS case was reported in 1986. One commonly used measure of the extent of HIV in a population is adult prevalence, the percentage of adults (ages 15 and older) who are infected with HIV. Although HIV prevalence was very low during the early 1980s, it has been increasing rapidly in the past few years. It is estimated that by 1993, adult HIV prevalence had increased to xxx percent. This means that there were about xxx HIV-infected adults alive in 1993. By 1996, it is estimated that adult prevalence has increased to xx percent. This means that there are about xx million HIV-infected adults alive today.

In urban areas prevalence was estimated to be much higher, about xx percent in 1993. In rural areas, adult HIV prevalence is estimated to have been xx percent in 1993.

From the estimate of adult infections, it is possible to calculate the number of children under the age of five who are infected with HIV. Most of these children received the virus from their mothers at the time of birth or shortly thereafter through breastfeeding. In 1996, it is estimated that there are xx HIV-infected children under the age of five.




HIV can be transmitted from one person to another in a number of ways. Four transmission mechanisms are most important: blood transfusion, unsafe injections, perinatal transmission and heterosexual contact.

**Heterosexual contact** The majority of infections are transmitted through heterosexual contact. The practice of multiple partner sexual contact is the biggest risk factor for HIV transmission. Partners of people who practice multiple partner sexual contact are also at risk. Thus, a woman whose husband has multiple partners is at risk even though she may be faithful to her husband.

**Perinatal transmission** Many children are infected perinatally; that is, they receive the infection from their mothers during pregnancy, at the time of birth or through breast milk. About 35 percent of babies born to infected mothers will themselves be infected.

**Blood transfusion** Transfusion with infected blood will almost always transmit HIV. However, most blood is screened for HIV. Therefore, few new infections are due to blood transfusions.

**Unsafe injections** HIV can be transmitted by injection if the same needle is used to inject many people, without being sterilized after each use. Proper health practice requires sterilization of needles after each use or the use of disposable syringes. However, some illegal injectionists do not follow these practices. These unsafe practices can result in some new cases of HIV infection.

The last two modes of transmission, homosexual contact and "other,"

## Risk Factors for HIV

- Sexual contact with multiple partners
  - Commercial sex
  - Extra-marital sex
  - Non-faithful partnerships
- Sexually transmitted diseases

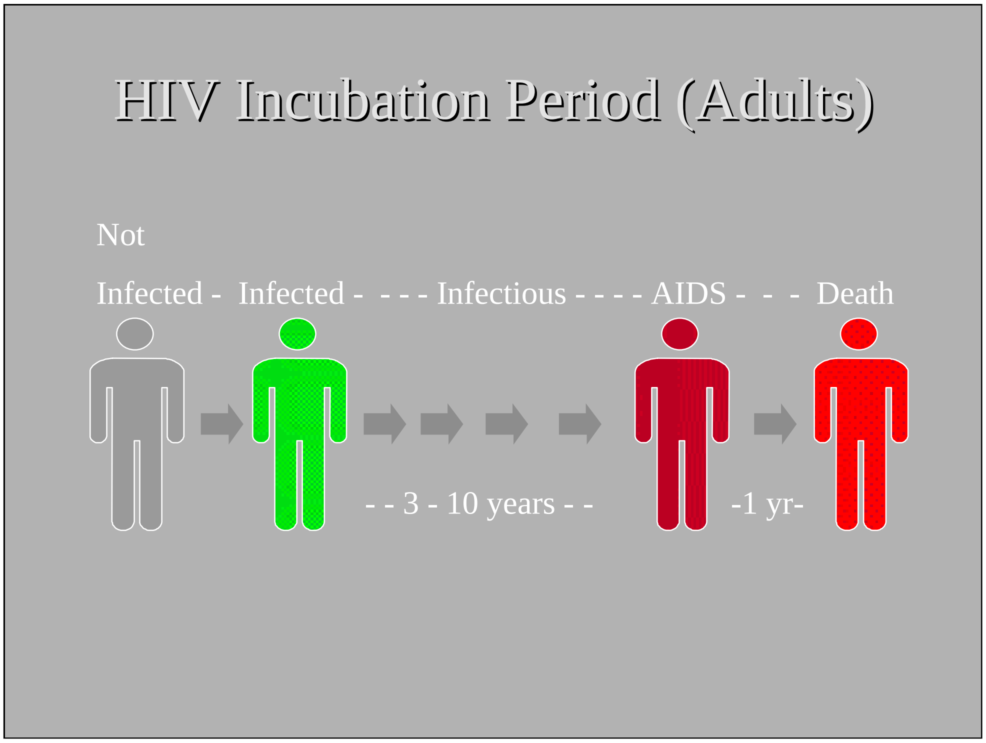
The two most important risk factors involved in the spread of HIV infection are having sexual contact with many different partners and having a sexually transmitted disease (STD).

People who have many sexual partners have an increased risk of acquiring the virus from one of those partners. Commercial sex workers have a particularly high risk because of the large number of different partners they have.

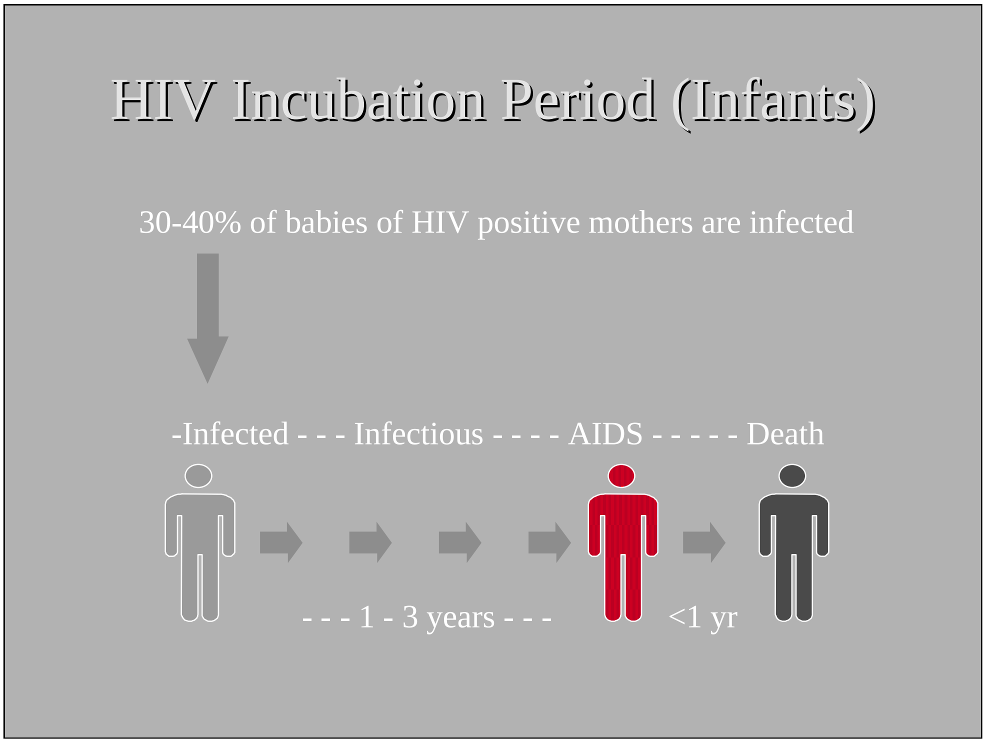
Men who visit commercial sex workers have a high risk of acquiring the virus. If a married man becomes infected through contact with a commercial sex worker, he may carry the virus home to his wife. Thus, even women who are faithful to their partners can be at risk of acquiring HIV if their husbands are not faithful.

Although the risk of HIV is highest for commercial sex workers, anyone engaging in sex with multiple partners is at risk of catching HIV.

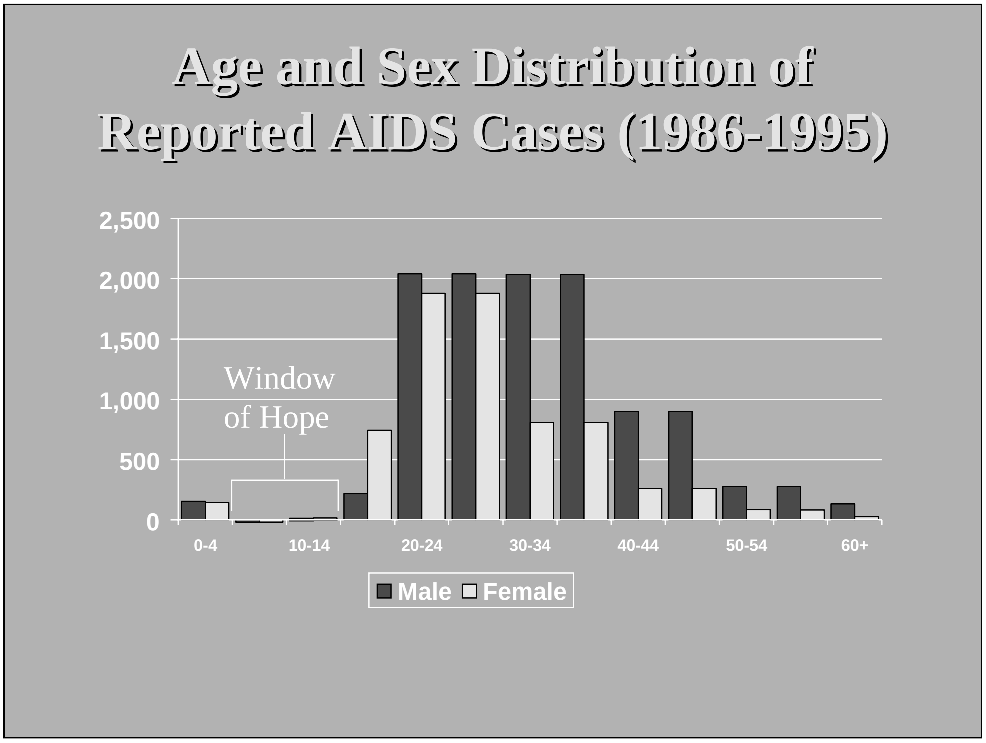
The presence of an STD can also increase the risk of acquiring an HIV infection. The presence of an STD in either partner makes it much more likely that the virus will be transmitted in each sexual contact. Individuals can avoid STDs by remaining faithful to one partner, using condoms or abstaining from sexual activity. Prompt treatment for STDs can shorten the duration of symptoms and reduce the risk of acquiring HIV or passing the STD to another partner.




A person does not develop AIDS as soon as he or she becomes infected with HIV. There is a lengthy incubation period that is usually about three to ten years. Some people may survive longer than 10 years with an HIV infection while others may develop AIDS and die two or three years after infection. The average time from infection with HIV to development of the disease AIDS is about 7 to 8 years. That is, on average, a person does not develop AIDS until 7 to 8 years after becoming infected. For most of this period the person may not have any symptoms and, therefore, may not be aware that he or she is infected. This contributes to the spread of HIV, since the person can transmit the infection to others without realizing it.




For children the incubation period is much shorter because their immune systems are not yet fully developed. Most children who are infected at birth or shortly thereafter through breastfeeding develop AIDS and die within two years.




The distribution of these cases by the age and sex of the patient is shown in the bar chart. Each vertical bar shows the number of reported AIDS cases in a particular age group. Males are shown in the bar on the left and females on the right.

Several interesting facts are illustrated by this bar chart.

•Over 80 percent of reported AIDS cases occur among adults between the ages of 20 and 49. Since this is the most economically productive part of the population, these deaths constitute an important economic burden. This is also the age when investments in education are just beginning to pay off. These deaths also have important consequences for children since most people in this age group are raising young children.

•There is roughly an equal number of male and female cases. This is because most infection is acquired through heterosexual contact.

•The peak ages for AIDS cases are 20-29 for females and 20-39 for males. Since AIDS cases result from HIV infection acquired 3-10 years earlier, this means that the peak ages for new HIV infection are 15-24 for females and 15-34 for males.

•The number of females infected in the 15-19 age group is much higher than for males in the same age group. This is due to earlier sexual activity by young females and the fact that they often have older partners.

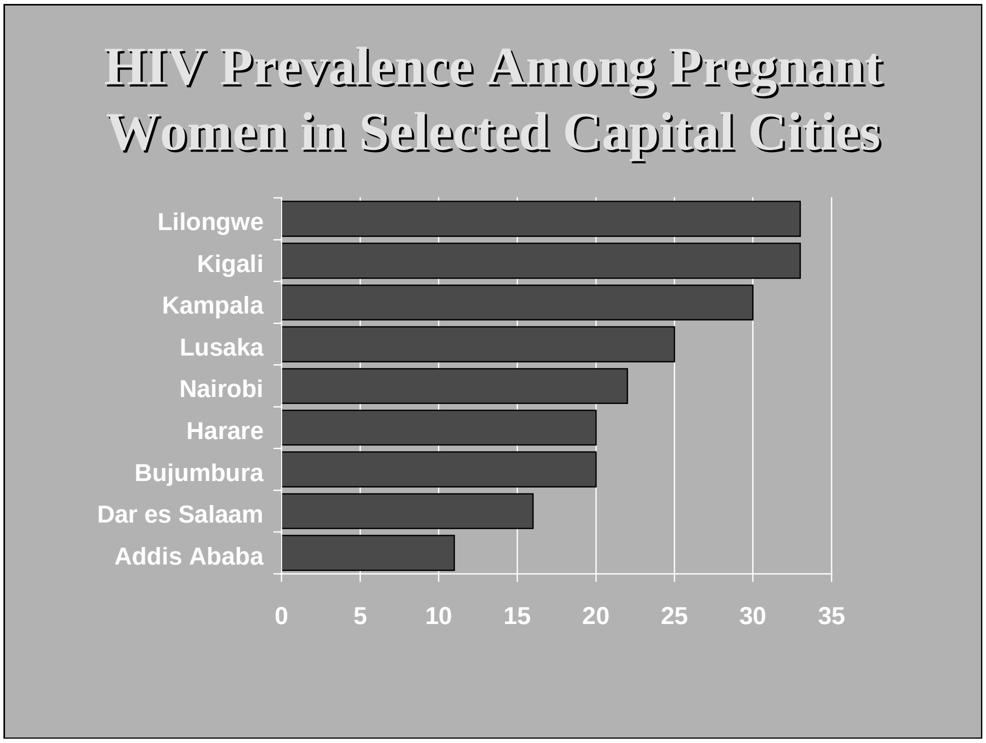
•There have been a significant number of AIDS cases reported among young children. Most of these received the infection from their mothers when they were born.

•The absence of many AIDS cases in the 5- 14-year-old age group shows that infection is not transmitted by mosquitoes or casual contact such as shaking hands or kissing.

•The absence of infection among children between the ages of 5-14 is the “Window of Hope.” If these children can be taught to protect themselves from HIV infection before they become sexually active, they can remain free of HIV for their entire lives. But action must be taken now, because rates of new infection are quite high once children

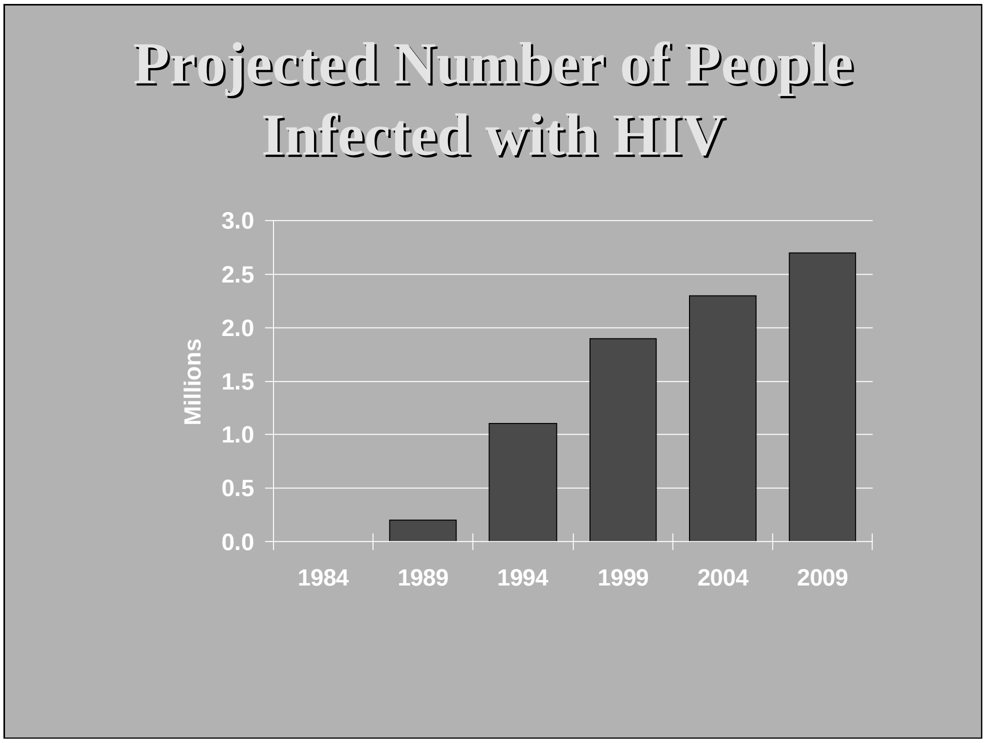
# Presentation Outline

- Background
- Projections
- Impacts
- Interventions
- Needs

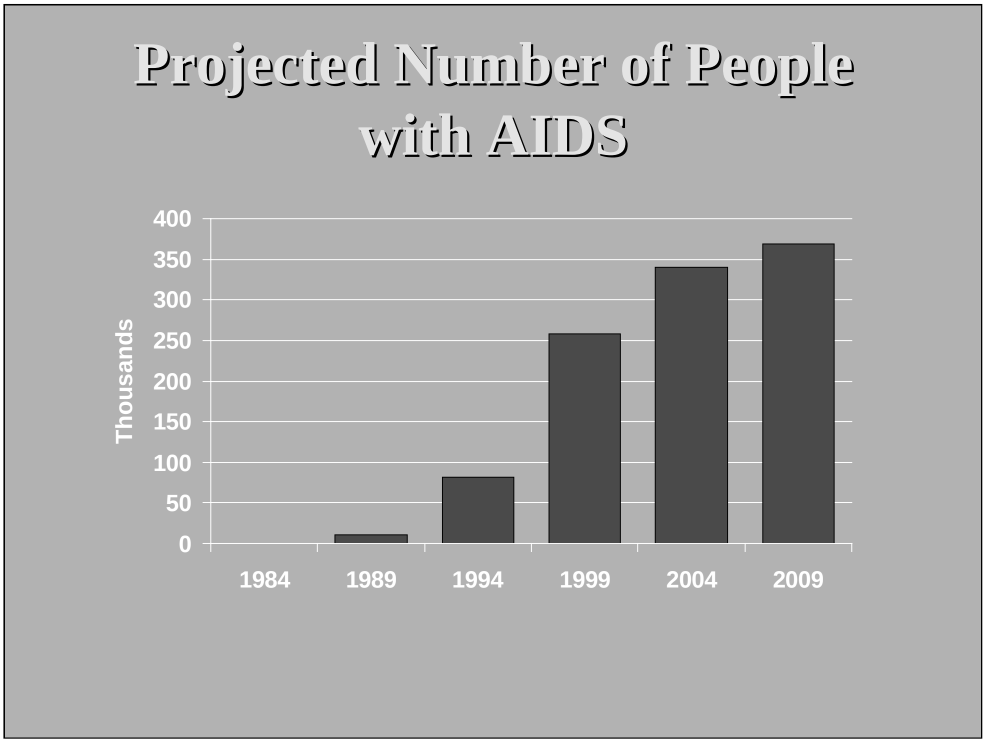



In order to project the number of new infections in the future, it is necessary to make an assumption about how rapidly HIV will continue to spread. Will adult HIV prevalence continue to increase in the future? If it does, how high might it go in the absence of expanded AIDS control programmes and significant behavioral changes: 6 percent, 12 percent, 20 percent?

Since prevalence seems to be increasing rapidly in most areas, it is likely that prevalence will continue to increase, at least for the next six or seven years. Although the national prevalence in 1993 was estimated at about xx percent, it was xx percent in urban areas. In other countries in Africa, urban HIV prevalence is even higher than in xx, as shown in the chart below [US Census Bureau, 1992]. This chart shows HIV prevalence for pregnant women, which reflects, more or less, the situation in the general population. Higher prevalence in other countries may be due to an earlier start of the epidemic in those countries or to different behavior patterns or both.

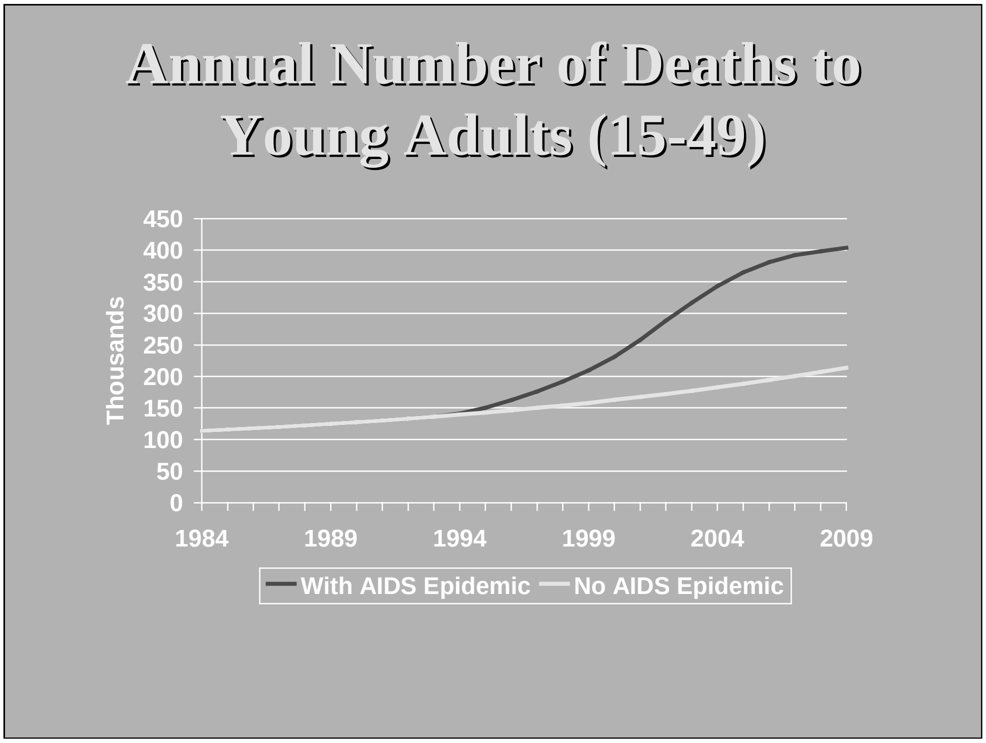



If HIV prevalence were to increase to xx percent by the year 2004, then the number of infected people in the population would increase to xx million people by 2000 and to xxx million by 2009.




The number of new AIDS cases each year resulting from these infections would increase to xx by 2000.

The cumulative number of AIDS deaths would increase from about xx in mid-1995 to xx by 2000 and to xx million by 2009.




AIDS would increase the death rate at all ages. However, the impact would be most severe among young adults and children under the age of five. Without AIDS, and assuming a gradual decline in the death rates from other causes, the annual number of deaths among young adults (ages 15 to 49) would increase slowly (because of the growing population) from about xx today to xx by 2009. However, AIDS would dramatically increase that number, to xx per year by 2009, a xx percent increase. This rapid increase in young adult deaths would have serious consequences for economic and social development. Many of these impacts are examined in the next section of this report.

## Presentation Outline

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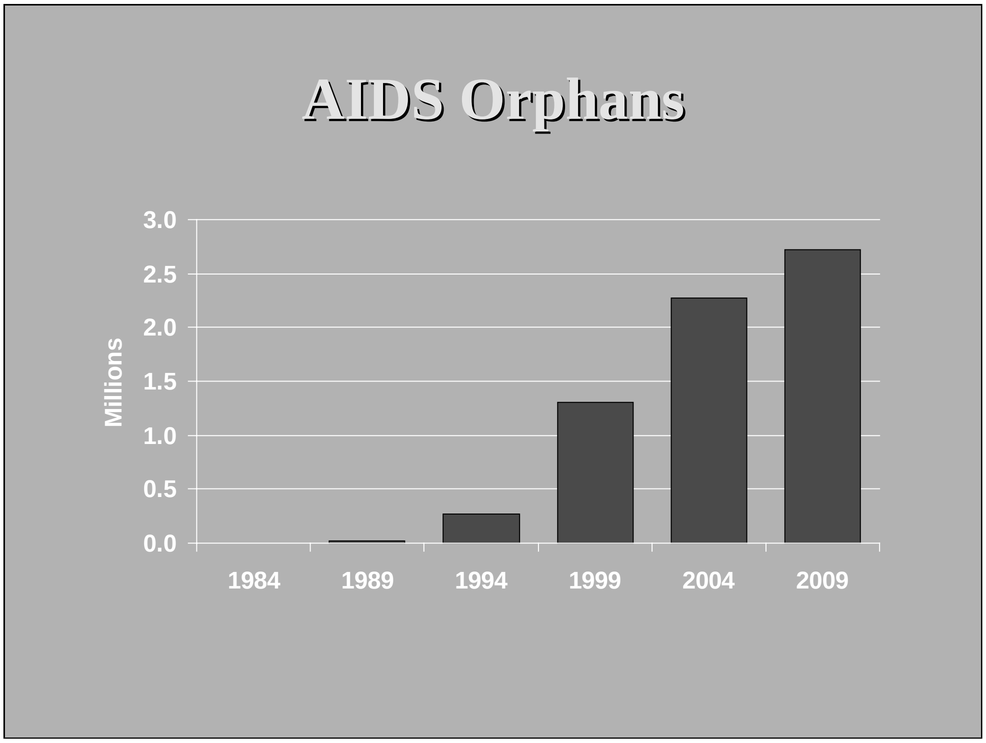
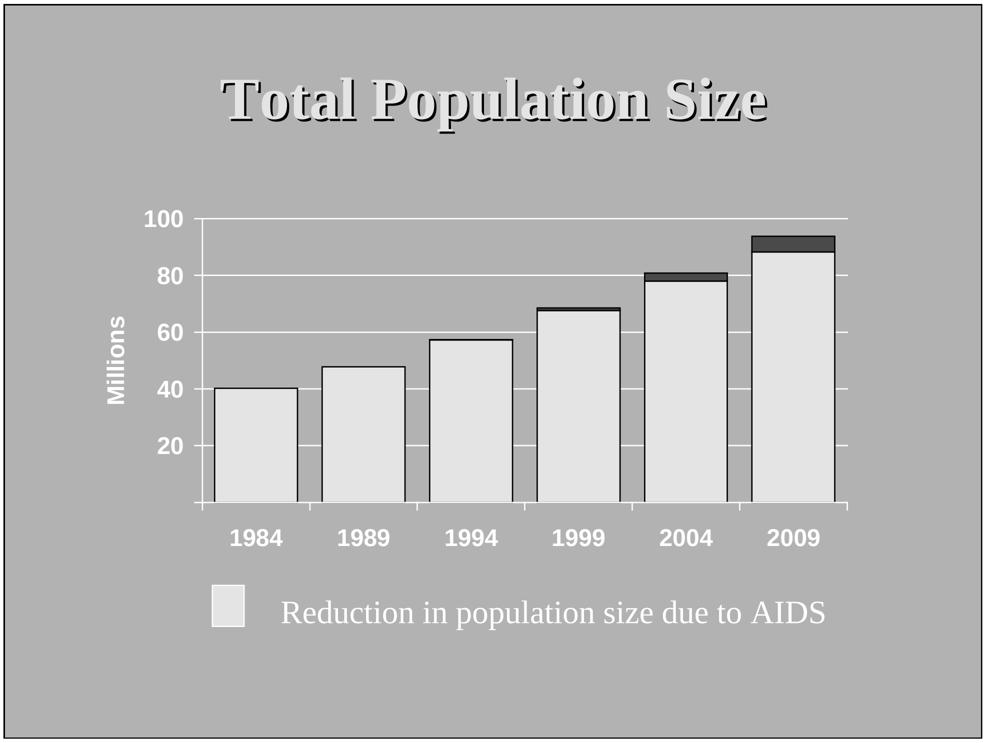



One of the worst impacts of AIDS deaths to young adults is an increase in the number of orphans.  Some children will lose their father or mother to AIDS and many more will lose both parents because of AIDS. The number of AIDS orphans could increase to xx by 2000 and to xx million by 2009.

These children may lack the proper care and supervision they need at this critical period of their lives. There will be a tremendous strain on social systems to cope with such a large number of orphans.

At the family level there will be increased burden and stress for the extended family which will try to care for these orphans. Many grandparents will be left to care for young children. Some families will be headed by children as young as 10-12 years old.

At the community and national level there will be an increased burden on society to provide services for these children, including orphanages, health care and school fees. Many children will go without adequate health care and schooling, increasing the burden on society in future years. There may also be an increase in the number of urban street children.

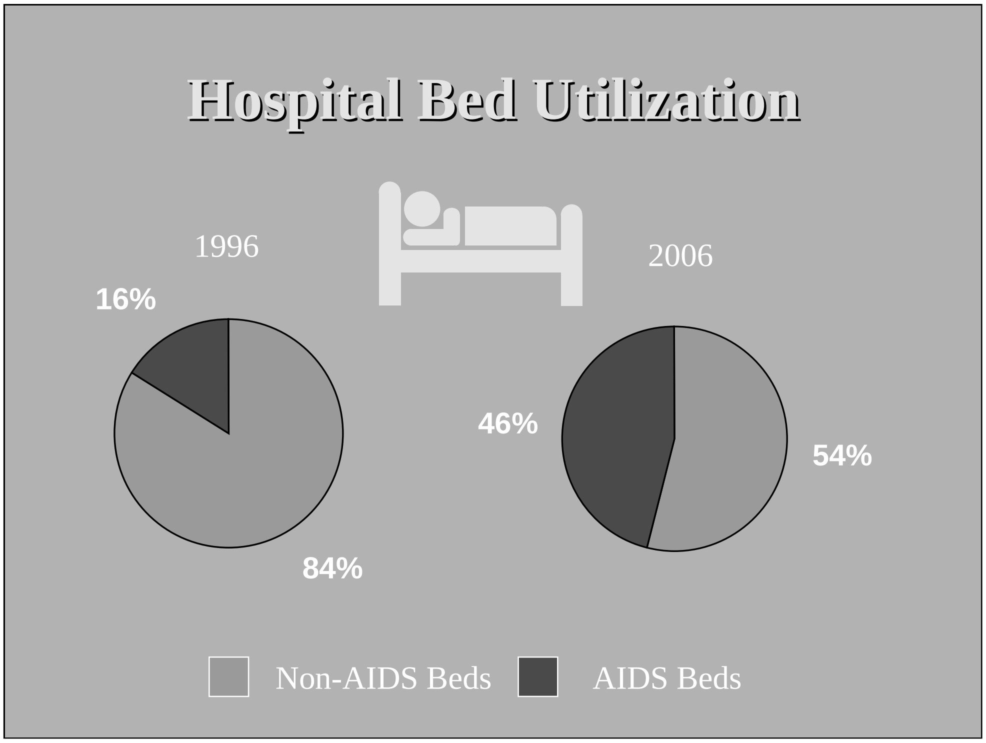



AIDS will have a large impact on population size. However, it will not cause population growth to stop or become negative. The following projection illustrates this point. The projection assumes that the total fertility rate (the average number of births per woman during her lifetime) declines, from about xx today to the national goal of xx by 2015. It also assumes that mortality from all causes other than AIDS continues to decline slowly, so that life expectancy increases from about xx years today to xx by 2007 if there were no AIDS deaths.

**If there were no AIDS epidemic**, the total population would increase from about xx million today to xx million by 2009. By 2009 the population would be growing at xxx percent per year.

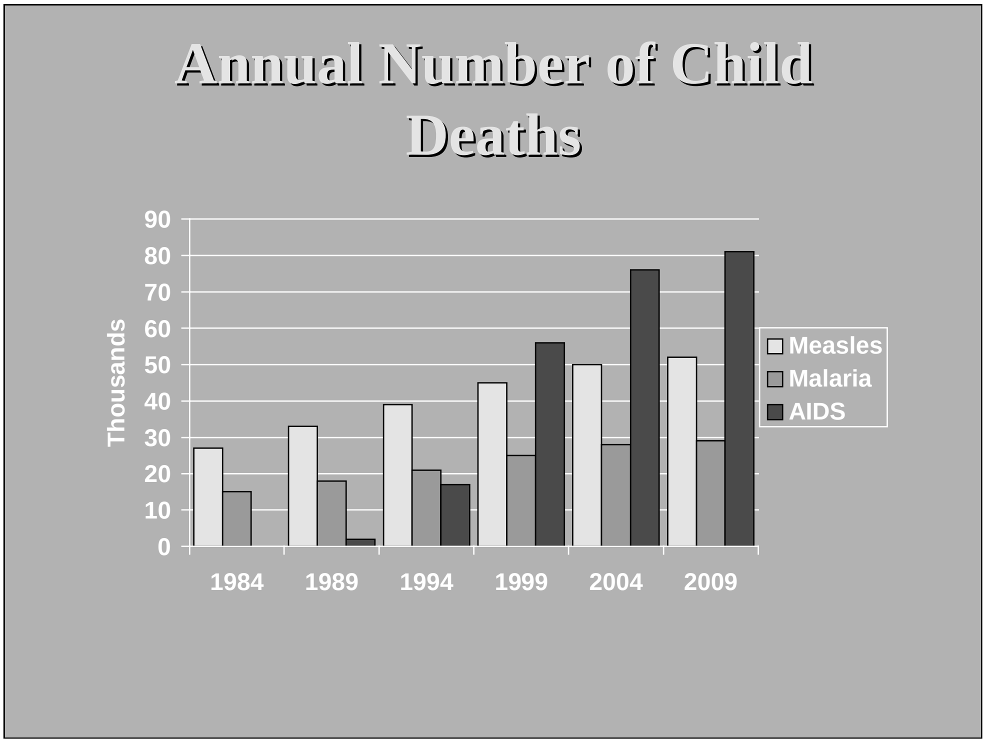
**With a continued AIDS epidemic**, the total population would be xx million by 2009, which is x million smaller than the projection without AIDS. Thus, the combined impact of AIDS deaths and fewer births because of a smaller reproductive-age population would result in almost xx million fewer people by 2009. However, by that time the population would still be growing at xx percent per year.

AIDS would have a significant impact on population size, but the population would still grow by almost xx percent by 2009. The growth rate of the population would be less because of AIDS, but it would still be xx percent per year. Changes in the total fertility rate, due mostly to the use of family planning, would have much more impact on the population growth rate than would AIDS deaths.




AIDS is an expensive disease that requires a considerable amount of resources from the health system. The cost of hospital care for AIDS patients is xx during the course of the illness. If the expenditure rate were to remain constant, then the total hospital costs for AIDS care, would increase to about xx million  by 2000 and to xx million by 2009. By 2009, expenditures for AIDS care could amount to xx of the entire budget of the Ministry of Health. Clearly, this would place a tremendous burden on the public health care system to provide adequate care for AIDS patients and still try to meet all the other health needs of the population.

The demand on health services caused by AIDS can also be illustrated by looking at hospital beds. Not all people with AIDS seek hospital care. But, for those that do, the average length of stay is considerably longer than for most other diseases, perhaps as long as 40 days. Today, as much as xx of all hospital beds in the country are occupied by AIDS patients. As the epidemic grows, so will the hospital bed requirements. By 2000 about xx percent of all hospital beds would be required for AIDS patients, if no new beds became available. This would leave an insufficient number of beds for patients for all other causes. Therefore, AIDS must be controlled or it will seriously affect the provision of health services to all.



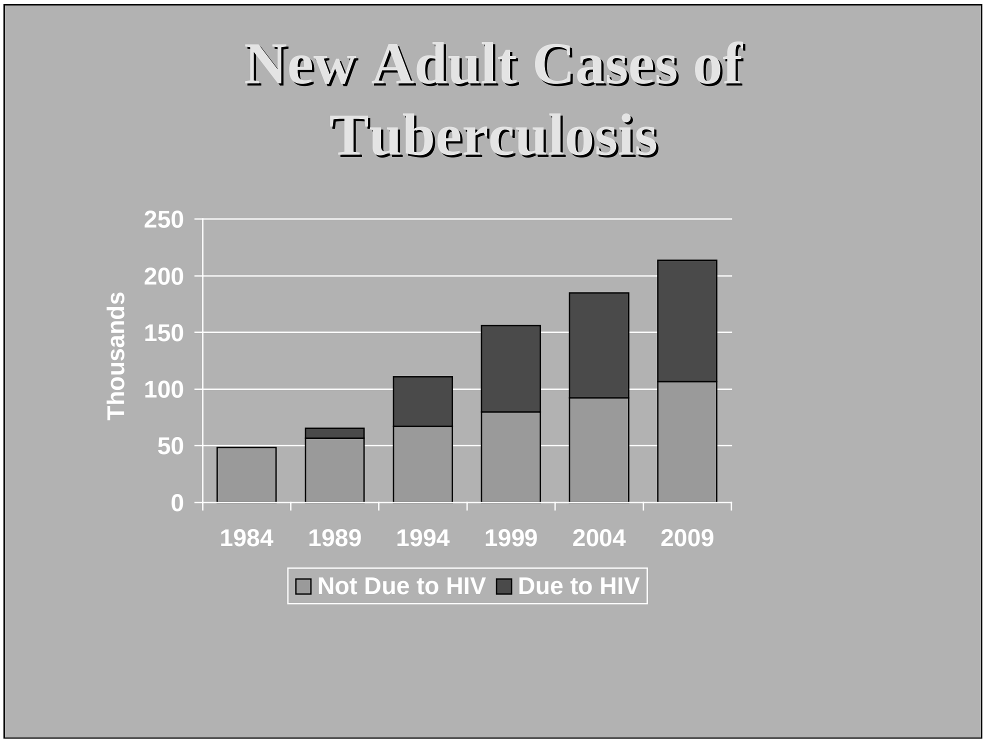

AIDS also affects child survival. About 30-40 percent of babies born to infected mothers will also be infected with HIV. Most of these babies will develop AIDS and die within two years. Few will survive past the age of five.

AIDS could soon become the major cause of child death, worse than other major causes such as measles and malaria. For example, the annual number of child deaths due to measles and malaria is expected to range between xx and xx through the year 2005. The annual number of deaths due to AIDS could reach xx to xx over the same time period.

The increasing number of child deaths due to AIDS threatens to reverse many of the recent gains of child survival programmes.

•The infant mortality rate is the number of infants who die during the first year of life per 1000 live births. It is currently around xx. Without AIDS the infant mortality rate might be expected to decline to xx by 2005. However, with AIDS, it would decline to only about xx.

•The child mortality rate is the number of children who die before reaching their fifth birthday per 1000 live births. It is currently around xx. Without AIDS it might be expected to decline to around xx by 2005. However, with AIDS it is likely to remain constant or rise slightly to xx.




Efforts over the past 20 years to control tuberculosis had been showing some success. However, recently the number of TB cases has been rising rapidly. This is due to the spread of HIV infection. HIV infection weakens the immune system of otherwise healthy adults. Many, perhaps half, of all adults in xx carry a latent TB infection which is suppressed by a healthy immune system. When that immune system is weakened by HIV, it can no longer control the TB infection and overt TB can develop.

In the absence of HIV, the number of new TB infections would be limited to about 0.2 percent of the population [Harries, 1990]. This would result in xx to xx new TB cases each year.

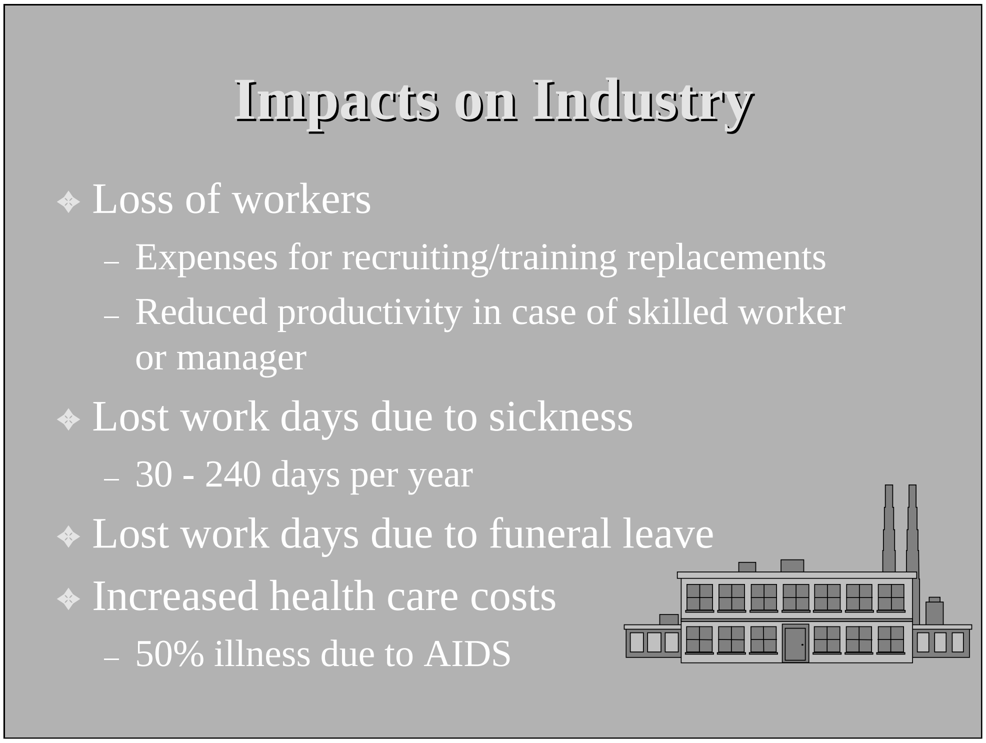
With AIDS, a number of new cases will develop. If we were to assume that among people with both HIV and latent TB infections, 8 percent would develop TB each year, then the additional number of TB cases due to HIV infection would be about xx by 2005. Even this is likely to be an under-estimate since these new cases may transmit the disease to others.

The impact of HIV infection on tuberculosis is a serious problem because TB is infectious through casual contact. It threatens to vastly increase the risk of tuberculosis for the entire population. Also, drug-resistant strains of TB are appearing, making it much more difficult and expensive to treat tuberculosis. The control of TB is very expensive and puts considerable strain on the health budget.

## Impact on Rural Households

- Grandparents may have full responsibility to care for children
- Children suffer in many ways
  - Taken out of school to reduce expenses and help at home
  - Malnutrition
  - Orphans

All members of rural families hit by AIDS are likely to be affected. Grandparents may have to assume full responsibility for raising the children when the parents die. Children are more likely to become malnourished, may become orphans and may have fewer opportunities for education if the family cannot afford the expense of education or needs the children to work in the home.




AIDS can have important impacts on the industrial sector as well. Since the prevalence of HIV infection is higher in urban areas, the industrial work force will be harder hit than the rural work force. When workers die from AIDS, they need to be replaced by the firm. Unskilled or semi-skilled workers may be easily replaced, because of the large number of unemployed people. However, this replacement requires additional expenses for recruiting and training workers.

When skilled laborers or managers are lost, they may be very difficult to replace and there may be a loss of productivity until new workers can gain the necessary experience.

The productivity of the enterprise is affected even before the employee dies, due to lost work days because of sickness. The number of work days lost to illness for a person with HIV/AIDS can range from as little as 30 to as many as 240 days in a year. Even healthy workers may need more time off from work to attend funerals of relatives and co-workers.

AIDS can also have a significant impact on health care costs for firms that provide health care for their employees. As the AIDS epidemic worsens, the burden from increased health care costs, lost work days, and reduced productivity could become a significant factor in the viability of the firm.

## Impacts on Rural Communities

- Loss of labour to attend funerals
- Expense of funeral and mourning contribution
- Need to care for AIDS orphans
- Worsening income distribution

AIDS affects rural households directly when it causes the death of a family member. Since AIDS primarily affects adults between the ages of 20 and 39, it is likely to affect the most productive members of the family. The male head of the household is responsible for special tasks, such as oxen cultivation, harvesting, threshing and farm management. The tasks most affected by the loss of the husband vary by region. If the male head of the household dies, the wife and other family members will have a hard time carrying out these tasks. The death of the wife to AIDS can make it difficult for other household members to carry out these tasks, in addition to caring for children.

In addition to the direct effects of labour loss, AIDS also affects rural households by reducing income and limiting savings and investment. The loss of income results from being unable to continue to plant and harvest crops as before. The effect is most severe when the husband dies from AIDS. The wife may be unable to continue farming and may have to lease the land to someone else. Financial problems and the loss of farming knowledge often result in reduced use of fertilizer and lower average yields.

In some households, the death of a family member to AIDS may result in a loss of remittances, if that member is a government employee or trader who sends money back to the family.

The death of a family member because of AIDS also leads to a reduction in savings and investment due to high care, funeral and mourning costs, perhaps several times the average household income. The stock of food grain may be depleted to provide food for mourners and the other expenses may be met by selling livestock. Such loss of productive assets only makes it harder to survive in the future.

## Impacts on Women

- Loss of secure source of income
  - May need to seek marginal employment
  - May lead to selling sex
- Loss of home
- Harder for women to protect themselves from HIV

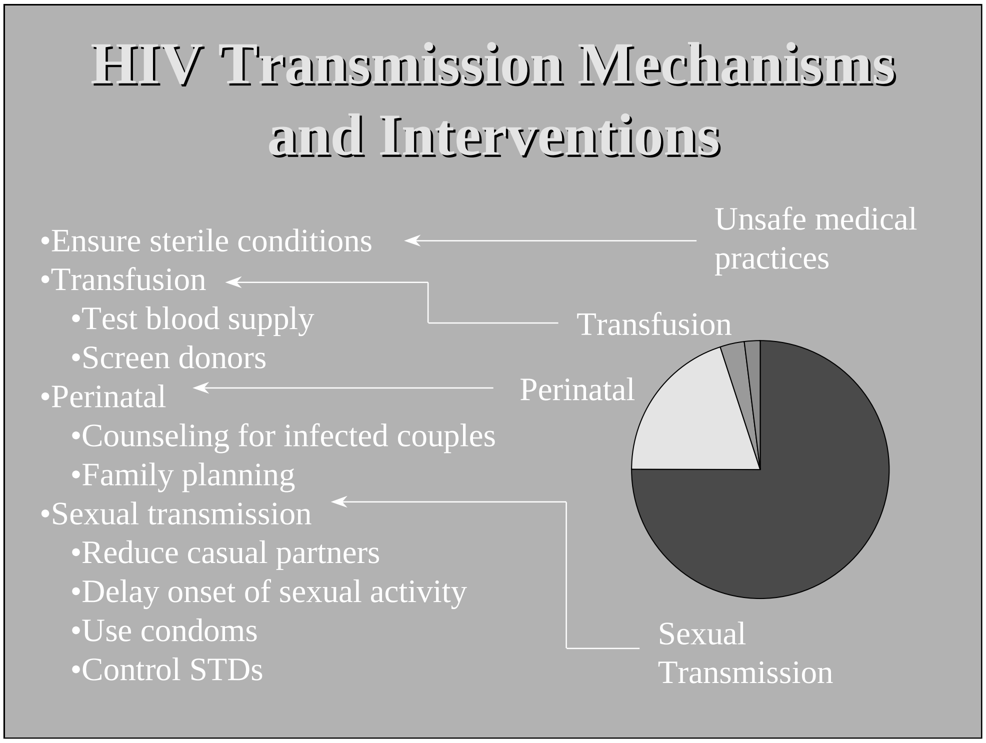
AIDS can have a very serious impact on the lives of women when it strikes a family member. In most cases women do not have a secure occupation which can provide a steady and adequate income. Thus, if the husband dies, the remaining wife and children can be particularly vulnerable. Some women may be exploited or may have to resort to selling sex to provide cash income.

A woman may also have reduced ability to be a provider for the family if she needs to spend a significant portion of her time caring for family members who are sick with AIDS. It may reduce the time she has for productive work as well as affect the amount of time she can spend caring for children. Since other tasks, such as food preparation, fetching water and fire wood, etc., must still be done, many women have to work even harder than normal in order to cope with AIDS in the family.

Women are also especially vulnerable to AIDS because they may have limited ability to protect themselves from HIV infection. If a woman's husband dies, she may be forced to sell sex if she cannot maintain herself and her children on the farm or with other occupations. A woman may be at risk of getting HIV even though she is faithful to her husband, because her husband has outside sexual partners. She may have little or no control over her husband's actions and no ability to protect herself by having her husband use condoms.

# Presentation Outline

- Background
- Projections
- Impacts
- Interventions
- Needs

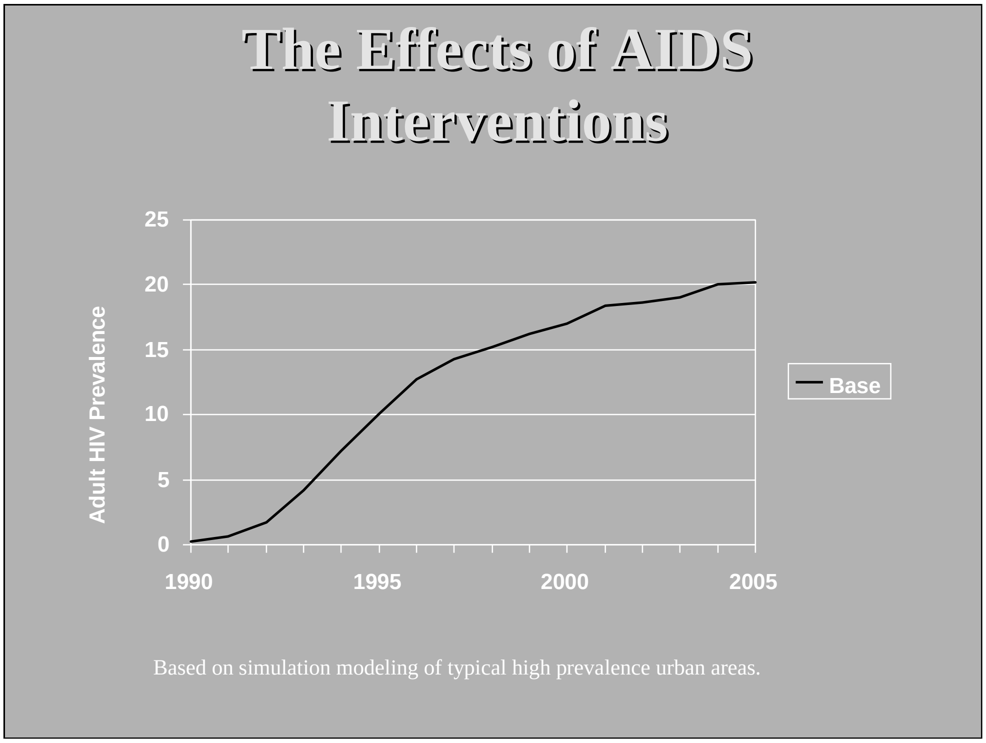



The impact of AIDS will be very severe if HIV infection continues to spread rapidly. However, there are several things that can be done to slow the spread of HIV.

To avoid infection through blood transfusion the blood supply needs to be made as safe as possible. This means screening blood through laboratory tests and screening potential blood donors through interviews in order to reject as donors those that have a high probability of being infected. The number of blood transfusions can also be reduced by eliminating all unnecessary transfusions.

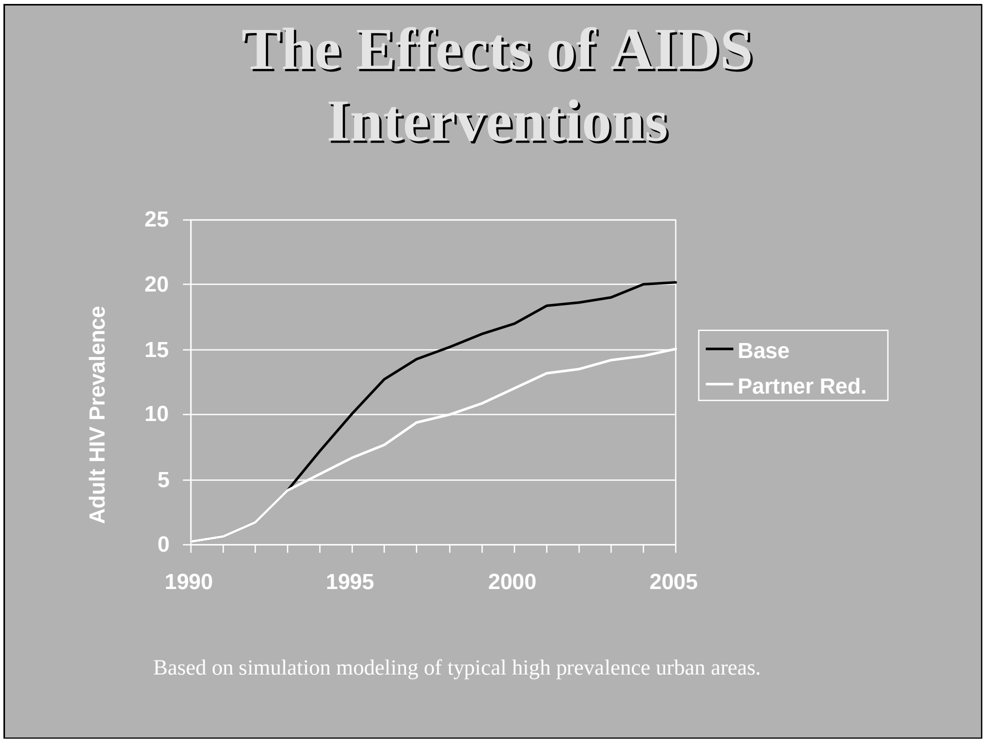
To reduce perinatal transmission it is important that young women know whether they are infected. If they are HIV-positive, they may wish to use family planning to avoid pregnancies. Counseling needs to be available for couples to help them understand the HIV test and the choices facing them.

The major mode of transmission is through heterosexual contact. People can protect themselves by avoiding sexual contact with multiple partners. The use of latex condoms can also reduce the risk of acquiring the HIV infection. Since the presence of a sexually transmitted disease can increase the chances of acquiring HIV during unprotected contacts, programmes to control STDs can also help reduce the number of new infections.

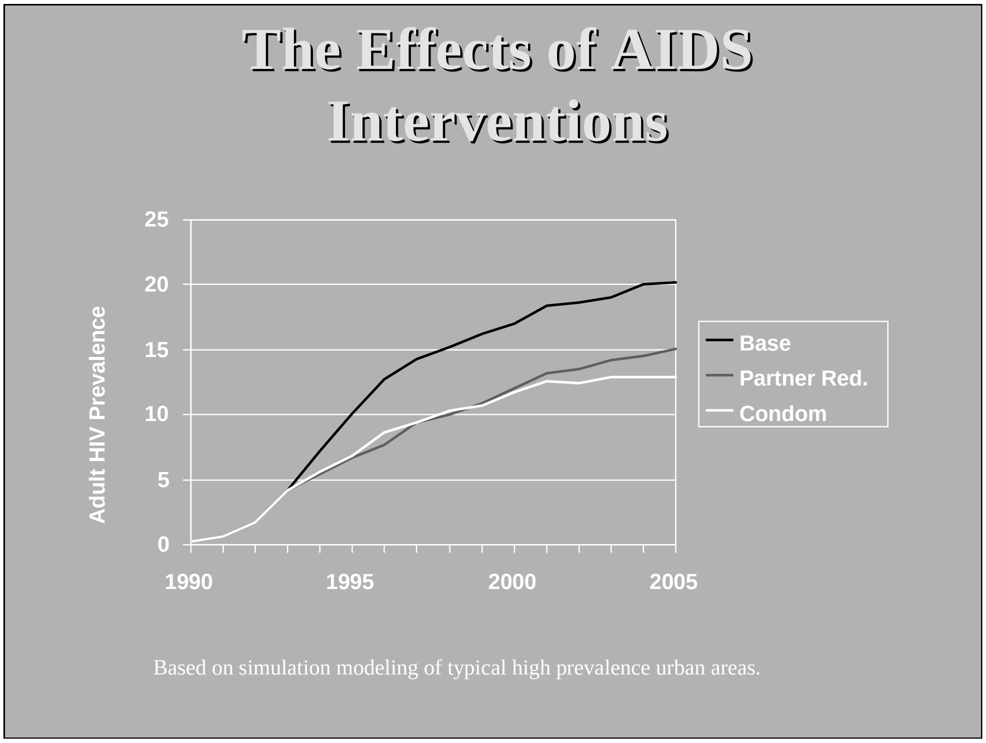



There has been much research worldwide to discover the best ways to slow the spread of HIV. These activities include information, education and communication programmes; counseling and HIV testing programmes; condom promotion and distribution; and STD control. Much success has been achieved in pilot studies, but much work needs to be done to apply these lessons at the national scale.

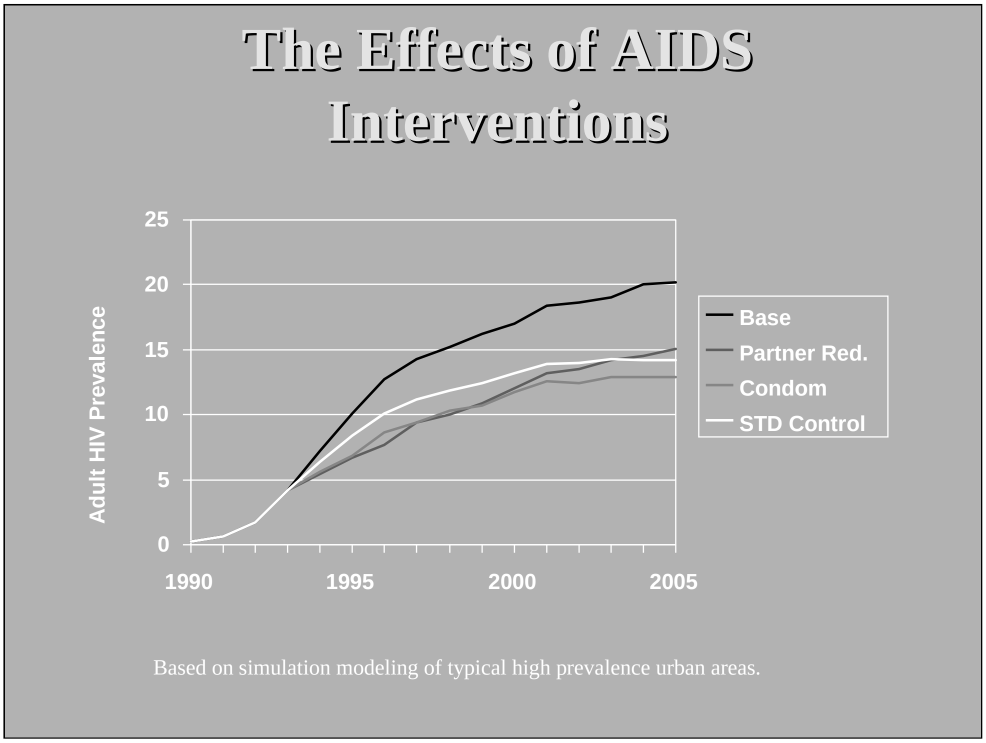
The potential impact of successful interventions can be illustrated using computer modeling. The following information was developed using two different models: the iwgAIDS simulation model [Seitz 1991; Stover 1995] and Simul-AIDS [Auvert 1991; Robinson 1995]. These models show the expected impact of interventions in a typical urban setting. In these illustrations it is assumed that adult HIV prevalence will increase to 20 percent with no interventions. The interventions are based on model intervention programmes being developed by the Global Programme on AIDS of the World Health Organization.



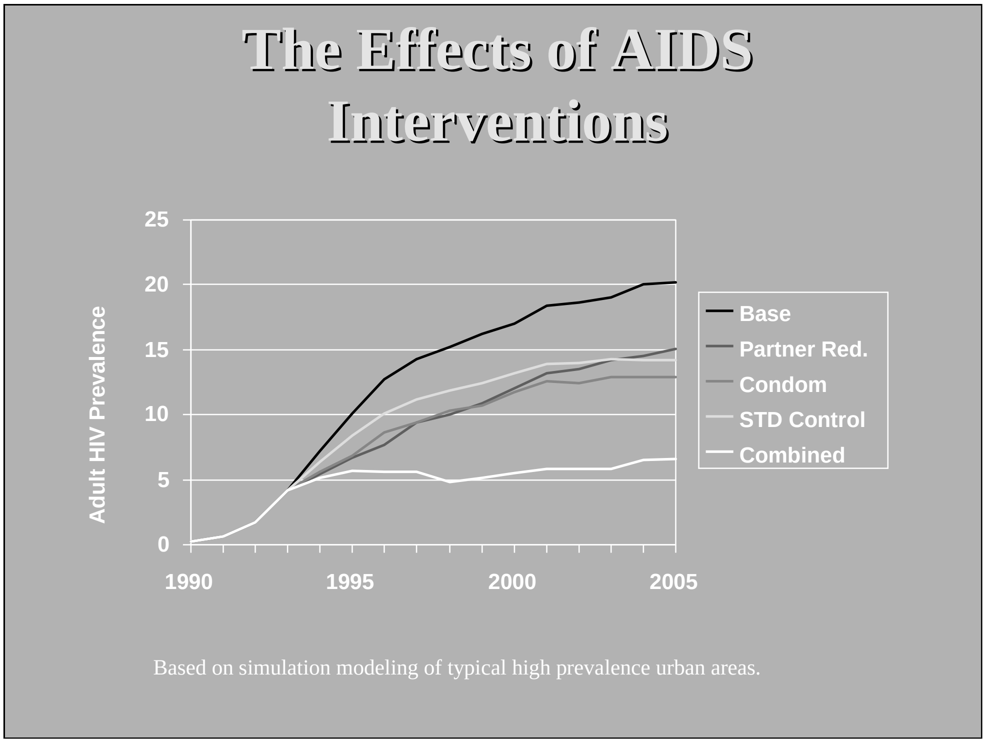

**Encourage people to remain faithful to one partner.** The first intervention focuses on encouraging people to remain faithful to a single partner. This could be done through a combination of mass media, counseling and education programmes. We assume that the result is a reduction of 50 percent in the number of men who visit commercial sex workers and an increase of three years in the average age at which sexual activity begins. If these interventions were implemented when prevalence reached about 5 percent, the result would be a 25 percent reduction in prevalence after 10 years. This is an important reduction in the spread of HIV, but not by itself a complete solution.




**Promotion and availability of condoms.** The second intervention is to promote condoms through mass media, counseling and education and to increase the availability of condoms through expanded public distribution, social marketing programmes with prostitutes and programmes in the workplace. This illustration assumes that condom use would increase to 60 percent for commercial sex workers, to 10 percent in contacts between men and their casual girl friends and to 5 percent among couples. Under these assumptions, prevalence would be reduced by 35 percent after 10 years.




**STD control.** The next intervention focuses on controlling the spread of sexually transmitted diseases such as syphilis and gonorrhea. This intervention involves improved services to detect and treat STDs. However, it should be noted that a comprehensive STD programme would also include condom promotion and education. It is assumed that through this intervention, correct treatment of STDs would increase to 60 percent for men and commercial sex workers and to 10 percent for all other women.  The result would be a 30 percent reduction in HIV prevalence after 10 years.




**Combined intervention.** Each of the interventions described above can make an important contribution to controlling the spread of HIV. However, none by itself will solve the problem completely. A much larger effect can be achieved by implementing all the interventions together. In the case illustrated here, combining the interventions would reduce HIV prevalence by two-thirds within 10 years. It is important to implement combined interventions in order to reach the maximum number of people. Some people will respond to one intervention while others will respond to another.

**Treatment and Vaccines.** There is no known cure for AIDS. There are several drugs that are recommended for the treatment of people with HIV infection or AIDS; however, the effectiveness of these drugs is primarily limited to combating opportunistic infections that arise because of the weakened immune system. They do not cure the HIV infection or prevent AIDS. Research on vaccines continues in many laboratories around the world. Most scientists believe that vaccines are not likely to be ready for mass use within the next 10 years. Even if vaccines become available, there will be problems in producing large quantities and delivering the vaccine to large numbers of people. Therefore, it does not appear that vaccines or drugs will contribute much to the fight against AIDS in the next several years.

## Presentation Outline

- Background
- Projections
- Impacts
- Interventions
- Needs

## National Policy on HIV/AIDS

- Prevention
  - Inform the population about the risk of HIV
  - Encourage people to remain faithful to one partner
  - Promote the use of condoms
  - Minimize unsafe medical and traditional practices
  - Ensure safe blood supply
- People with AIDS
  - Support people with AIDS and their families
  - Respect the human rights of people with AIDS
- Participation by all government and community organizations

(The contents of this slide will depend on the AIDS policy situation in the country.)

## National AIDS Control Programme

- Established in 1987
- Second Medium Term Plan (1992-1996)
  - Major emphasis on prevention
  - Multi-sectoral approach
  - Decentralization of prevention activities
- Participation of other Ministries
- Participation of NGOs (condom promotion, counseling, peer education, patient care)

(The contents of this slide will depend on the AIDS program in the country.)

## What Needs to be Done

- Strengthen multi-sectoral approach
- Establish effective coordination
- Incorporate family life education in school curricula and informal education for youth
- Assign capable and experienced staff at national and regional levels
- Increase government funding
- Provide strong political support

(The contents of this slide will depend on the needs in the country.)

## References for Typical AIM Presentation:

Auvert, B. 1991. "The Auvert Approach: A Stochastic Model for the Heterosexual Spread of the Human Immunodeficiency Virus." In *The AIDS Epidemic and Its Demographic Consequences*. Proceedings of the UN/WHO Workshop on Modeling the Demographic Impact of AIDS in Pattern II Countries: Progress to Date and Policies for the Future, December 13-15, 1989. New York: United Nations.

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